Orbit

Journal of the Radio Amateur Space Program

No. 12

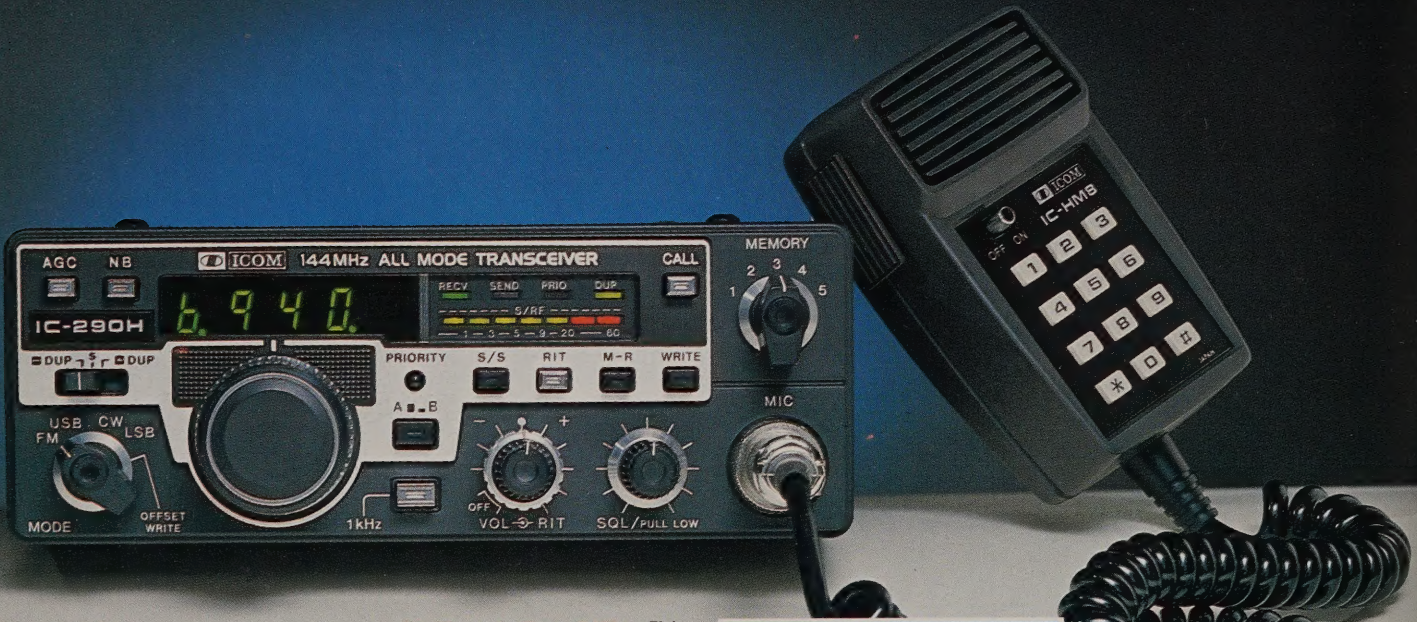
January/February 1983
$2.00 U.S.A./Canada

Published by AMSAT — The Radio Amateur Satellite Corporation

Multimode Mobile Magic

IC-290H & IC-490A

ICOM's latest state of the art 2 meter and 440MHz multimode transceivers.



IC-290H

25 Watts of Power. A full 25 watts in all modes gives extra communication range in the IC-290H.

Green LED Readout. For improved readability in bright sunlight.

Dual VFO's. Provide ease in marking frequencies. Tuning rates are 5KHz in FM, 100Hz in CW and SSB, and 1KHz with the tuning speed button pushed.

Priority Channel. Any memory channel can be monitored for activity on a sample basis, every 5 seconds, without disruption of a QSO conducted on a VFO frequency.

Adjustable Power Levels. Both the hi and lo power levels are independently adjustable for meeting simplex or amplifier input requirements.

Squelch in All Modes. Standard noise squelch in FM and AGC derived squelch for CW and SSB reduce fatigue factors and allow scanning silently while looking for band openings or satellite signals.

Multimode Capability. FM, SSB, and CW modes provide solid communication modes for repeater, simplex, satellite or the CW enthusiast. Sidetone is provided on CW.

Adjustable Duplex Splits. Offset may be changed from its initial value by pressing the priority button while in VFO mode, then rotating the main tuning knob. The offset is displayed on the frequency readout.

Scanning (S/S). Memory scanning and full or programmable band scan are standard features. Internal switches select busy/empty modes, adjustable delay or carrier operated resume, and full or program band scan.

Memory Backup. The optional, heatsink mounted, BU1 memory backup battery option provides retention of memory when moving the transceiver from one power source to another.

Touchtone® Microphone Supplied. Each unit comes with a touchtone® microphone as the standard unit microphone.

IC-490A

The operational characteristics of the IC-490A are the same as the IC-290H except for the following chart.

		IC-290H	IC-490A
Freq. Range (MHz)		143.8-148.199	430.0-439.999
Power	Hi	25	10
	Lo	1	1
Memories		5	4
Initial Offset		600KHz	5MHz
1MHz Up Button		Not Req'd	Yes
Normal Tuning Rates (KHz)	FM1	5	5
	FM2	Not used	25
	SSB	0.1	0.1
	CW	0.1	0.1

ICOM

The World System

ICOM America, Inc., 2112-116th Ave NE, Bellevue, WA 98004 **(206)454-8155**/3331 Towerwood Drive, Suite 307, Dallas, TX 75234 **(214)620-2780.**

All stated specifications are approximate and subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions.

Orbit

January/February 1983
Volume 4 Number 1

***ORBIT* Staff**
Editor in Chief: V. Riportella, WA2LQQ
Assoc. Editor: Dom Mallozzi, N1DM
Asst. Editors:
Harold Winard, KB2M
Bob Ruedisueli, W4OWA
Managing Editor: Bob Myers, W1XT
Illustrations: Doug Dowie
Advertising Dir.: Roger Soderman, KW2U

Editorial Committee
Greg Roberts ZS1BI,* Joe Kasser G3ZCZ, Harry Yoneda JA1ANG, Alex Schoening DC7AS, Niko Janssen PA0DLO, Ross Biggar ZL1WN, Ralf Hucke CE6EZ, Domenico Marini I8CVS, John Pronko W6XN, Steve Place, WB1EYI, Larry Roberts W9MXC, Ron Broadbent G3AAJ

AMSAT Board of Directors
John Browning W6SP,* Tom Clark W3IWI, Rich Zwirko K1HTV, Jan King W3GEY, Pat Gowen G3IOR, Harry Yoneda JA1ANG, John Henry VE2VQ
*Chairman

AMSAT Officers
President: Tom Clark, W3IWI
Executive Vice President:
Vern Riportella, WA2LQQ
Vice President Engineering:
Jan King, W3GEY
Vice President Operations:
Rich Zwirko, K1HTV
Vice President Special Projects:
Bill Brown K9LF
Office Manager: Martha Saragovitz
Treasurer: Roy Rosner, K4YV

Editorial Office: P.O. Box 177,
Warwick, NY 10990

Advertising Office: 221 Long Swamp Road, Wolcott, CT 06716

AMSAT: P.O. Box 27, Washington, DC 20044.
Telephone: 301 589-6062
Telex: 248-566

Second Class postage paid at Waterbury, Conn. by *ORBIT*, 221 Long Swamp Road, Wolcott, Connecticut 06716.

ORBIT (USPS 041-850) is published six times per year for $10. (inseparable from membership dues of $16).

Copyright © 1983 by AMSAT. Contents may be reproduced without specific permission provided proper credit is given, unless otherwise stated and copies are sent both to AMSAT and to the author. Opinion expressed is not necessarily that of AMSAT.

CONTENTS:

Technical Features:

4 **Helix Review** By Dom Mallozzi, N1DM
What type of antenna will you use for Phase IIIB? Maybe this review will influence you!

8 **Improving Mode-A Station Performance** By Ray Soifer, W2RS
A recognized expert reveals keys to Mode-A DX success.

10. **WAS-50 From Hawaii** By Rick G. Dittmer, WH6AMX
Making 50 the hard way . . . from mid-Pacific.

Informational Topics:

12 **AMSAT Bulletin Board System** By Robert J. Diersing, N5AHD
A basic "how-to-use" guide to this vital information bank.

19 **AMSAT Software Exchange (ASE) Update**
By Robert J. Diersing, N5AHD
The ASE Manager delineates procedures and describes problem areas.

22 **Product Highlight File: L-Band Transmitting Equipment by SSB Electronics** By Gordon Hardman, ZS1FE/KE3D

24 **Satellite Oddities** By Roy Hill, W4PID

Departments:

3 **Ellipsis . . .**By Vern Riportella, WA2LQQ

32 **AMSAT News**

26 **Satellite Log** By Geoffrey Falworth

28 **Worldwide Satellite Activity** By Pat Gowen, G3IOR

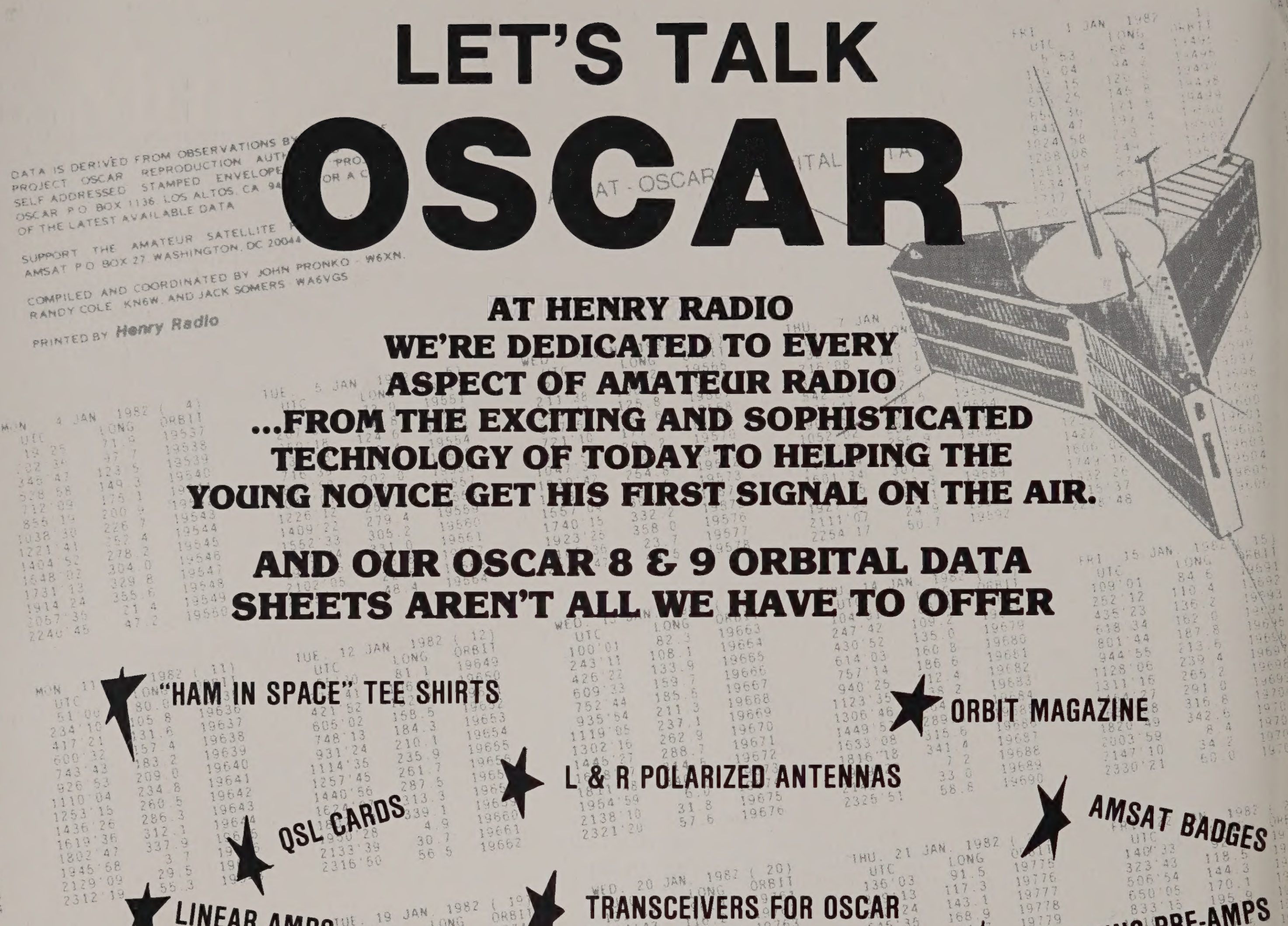
25 **W6 Space Philosopher** By John Browning, W6SP

20 **Around the World** By Kaz Deskur, K2ZRO

24 **Letters**

Our Cover: Thanks to Dr. Robert Leonard, KD6DG, for providing us with this print of the SRI International dish antenna system used to restore UoSAT to an operational condition. Can you identify the year (approximately) that this photograph was taken?

LET'S TALK
OSCAR


DATA IS DERIVED FROM OBSERVATIONS BY
PROJECT OSCAR REPRODUCTION AUTH
SELF ADDRESSED STAMPED ENVELOPE
OSCAR P.O. BOX 1136 LOS ALTOS, CA 94
OF THE LATEST AVAILABLE DATA
SUPPORT THE AMATEUR SATELLITE
AMSAT P.O. BOX 27 WASHINGTON, DC 20044
COMPILED AND COORDINATED BY JOHN PRONKO - W6XN.
RANDY COLE KN6W. AND JACK SOMERS WA6VGS
PRINTED BY Henry Radio
AMSAT-OSCAR

AT HENRY RADIO WE'RE DEDICATED TO EVERY ASPECT OF AMATEUR RADIO ...FROM THE EXCITING AND SOPHISTICATED TECHNOLOGY OF TODAY TO HELPING THE YOUNG NOVICE GET HIS FIRST SIGNAL ON THE AIR.

AND OUR OSCAR 8 & 9 ORBITAL DATA SHEETS AREN'T ALL WE HAVE TO OFFER

- ★ "HAM IN SPACE" TEE SHIRTS
- ★ ORBIT MAGAZINE
- ★ L & R POLARIZED ANTENNAS
- ★ QSL CARDS
- ★ AMSAT BADGES
- ★ LINEAR AMPS
- ★ TRANSCEIVERS FOR OSCAR MODES A, B & J
  - ICOM
  - KENWOOD
  - YAESU
- ★ RECEIVING PRE-AMPS
- ★ ORBIT PLOTTERS
- ★ ASTRON POWER SUPPLIES
- ★ AZMUTH & ELEVATION ROTORS
- ★ ORBIT CALENDARS

IN FACT, **WE HAVE IT ALL...WE ARE OSCAR SPECIALISTS!**

HENRY RADIO leads the way. Let us answer your questions and help you with your needs. Give us a call—at the L.A. store ask for Jack (WA6VGS)

HENRY RADIO 54 YEARS OF SERVICE

Henry Radio

2050 S. Bundy Dr., Los Angeles, CA 90025 (213) 820-1234
931 N. Euclid, Anaheim, CA 92801 (714) 772-9200

TOLL FREE ORDER NUMBER: (800) 421-6631
For all states except California.
Calif. residents please call collect on our regular numbers.

Ellipsis...

AN EDITORIAL BY VERN RIPORTELLA, WA2LQQ*

There are two things we wish for AMSAT in 1983. We wish a successful Phase IIIB launch. And we wish an improved *Orbit* Magazine for the new year as well!

We've been reading and listening to your comments about your magazine over the last year and they're pretty interesting. You really like the magazine, basically, but when it doesn't come when expected you're really disappointed. We understand you're sentiments and are really trying to get on a regular schedule with *Orbit*. But with an all-volunteer staff and meager resources, it's darn difficult to do all the things we'd like to do with this fine magazine.

Now we're not ones that generally offer nor easily accept excuses in place of performance. We figure you're about the same on that score too. So we aren't offering any excuses. But by the same token we do feel we owe you an explanation as to why when we planned to have a magazine out every other month we couldn't quite make it. Why, in fact, *Orbit* is affectionately, if a bit facetiously, called "Aperiodic Excellence!" *Orbit* magazine was born from a perceived need to upgrade the quality and quantity of published material available to members. *Orbit* was to have a four-fold purpose: 1. To provide a "literature" resource of articles on amateur satellites. 2. To provide a meaningful "token" for membership. 3. To provide a unifying element for the organization. 4. To attract new members with an attractive, "glossy," colorful publication as good as the best available in amateur radio magazines.

In many respects *Orbit* started out in that direction under founding Editor, G3ZCZ. Joe had been Editor of the predecessor to *Orbit*, AMSAT's quarterly publication, *AMSAT Newsletter*.

G3ZCZ set the stage and many precedents for *Orbit* in his tenure at the helm. But in early 1981, Joe announced that he would resign in connection with his transfer to 4X4-land. The job of *Orbit* editor was held open for any taker for months. No one stepped forth. In desperation President W3IWI turned to your editor to keep the presses rolling as an interim editor until a permanent replacement could be found. Accepting the new task was a very difficult decision. Having at least three other "hats" for AMSAT was a burden. Adding another was flirting with disaster. Yet somehow, with the help of Managing Editor W1XT and some competent column-writing from K2ZRO, W6SP and G3IOR we've managed to get to this point. But the burden is, I'm sure, showing. It is no longer possible for WA2LQQ to continue at the present workload.

What does this mean in terms of *Orbit's* future?

A month or two ago I thought that *Orbit* would have to be shelved...put on "hold" indefinitely until a new editor could be found. There seemed no alternative. Moreover, for various reasons the out-of-pocket costs to AMSAT of the magazine were running higher than expected and a short "retirement" for *Orbit* began to look attractive for financial reasons as well. Would *Orbit* survive to see the Phase III launch after all?

Well there's a happy ending to this true story. As in the movies, in rode the cavalry in the nick of time to rescue the besieged editor. In this scene the cavalry comprises N1DM (Dom Mallozzi), W4OWA (Bob Ruedisueli) and KB2M (Harold Winard). In short order these three heroes strode up to say, in effect, "We'll save this magazine!"

And they will!

Beginning immediately these three AMSAT veterans will be assuming growing responsibility in the editing and production coordination of your *Orbit* magazine. And a fine staff they are indeed. N1DM works for Raytheon, a major New England electronics manufacturer. W4OWA recently retired after a rewarding career with the Long Lines Division of AT&T. KB2M is an experienced editor with *Electronic Design Magazine*.

It is with pleasure (and no small measure of relief) that we welcome our new editors aboard. Each brings with him a unique and special suite of talents. Each is a staunch advocate of the ideals of amateur space utilization. And each will lend his touch to the creation of your continuing pleasure in *Orbit*. As we begin the transition to the new team we can be optimistic that *Orbit* will improve in regularity. And the quality of content and presentation you've told us you enjoyed so much will be preserved. We take satisfaction in knowing that we helped shape the team that "rescued" *Orbit* from grave peril. Please make the new team feel welcome and give them your full support!

**Editor-In-Chief*

Helix Review

By Dom Mallozzi,* N1DM

What type of antenna will you use for Phase IIIB? A Helix might just be the answer.

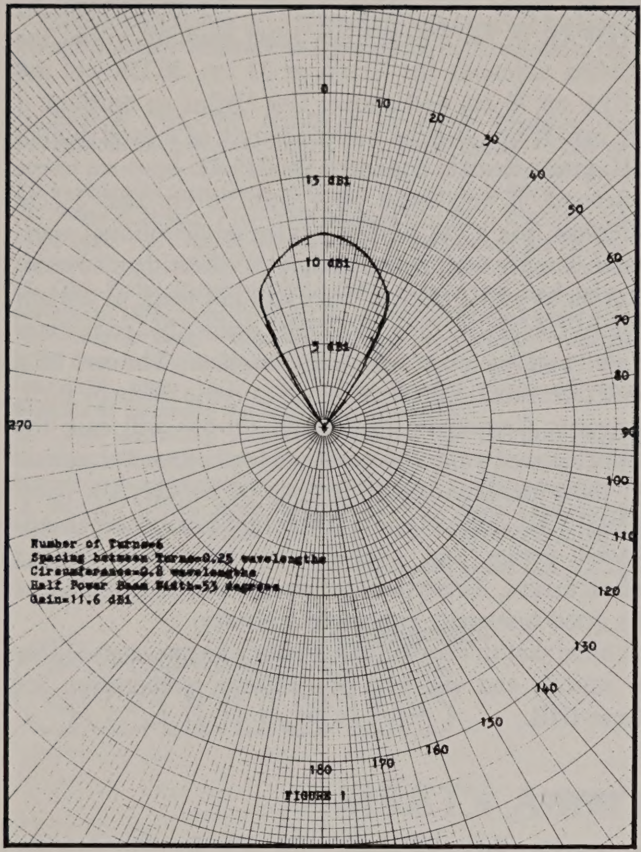
With the coming launch of Phase IIIB, many hams are preparing improvements and additions to their stations for use with the new bird. Because circular polarization is a necessity with Phase III, many hams are studying which antenna to use. Along these lines, Dick Jansson, WD4FAB has written three articles in *Orbit*[1], [2], [3] about helical antennas. It might be instructive to expound a bit more on Dick's articles. In this article I will address a few of the common questions on helicals with explanation to further understanding the construction of a helical antenna.

One of the most-asked questions is: What diameter should the conductor of the helical be? To answer this question I referred to the authoritative text on helicals, Kraus' "Antennas."[4] Dr. Kraus (W8JK) states that conductor diameters from 0.006 wavelengths to 0.05 wavelengths result in the normally recognized helical characteristics. Table 1, below, shows the acceptable conductor diameters for the helicals that will be common for Phase IIIB.

As stated by WD4FAB, ¼" copper tubing is great on 436 MHz.[2],[3] I have used helicals made of it on Mode B and they work well and tolerate the New England weather too! Also, it is stocked by most hardware stores and is relatively easy to work with. For 2 meters, tubing of the required size is difficult to form and is usually very expensive. I used a suggestion from some NASA papers[5] and used a piece of RG8 for the element. Its shield is just about the right diameter for 2m helicals and it is easy to form. I take the center conductor and short it to the shield at each end. For those thinking of 1269 MHz the ¼" copper tubing still looks like a good bet.

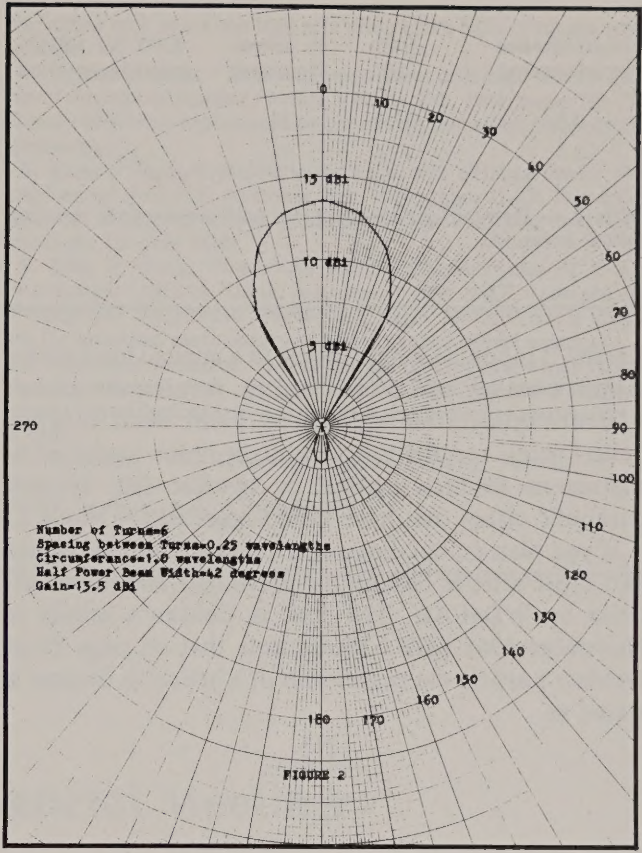
Now we come to the matching system. WD4FAB states that the stub matching system described by W7US[6] will not work as presented. This is not true. I have used just that matching system on my helicals for Mode B for the past three years and it performs fine. The other method mentioned in WD4FAB's article was presented in *QST* by K6ZMW.. I have not tried it personally but it looks good. After all, it was developed by W8JK,[8] so it will no doubt work like a charm. A third method was presented by DeMaw in *QST*.[9] It involves a ¼ wavelength series matching transformer made of coax transmission line. In fact, those wishing to use their helicals over the entire 70 cm band (420-450 MHz) might wish to consider the 2-series-quarter-wave transformers suggested by Stegen.[10] Stegen's method will result in improved SWR characteristics throughout the whole band. (For the limited bandwidth used for amateur satellites any of the methods mentioned previously will perform well.) If you plan to use quarter wave matching transformers to match a 50 ohm transmission line to a 1 wavelength circumference helical, you will require a coax line of about 84 ohms for the matching section. You can build this as suggested by DeMaw or you can change the feedpoint impedance of the helical to make the matching transformer a "standard" impedance for commercial coax. In my article in the *AMSAT Newsletter*[11] I suggested a helical circumference of 0.8 wavelengths. This reduces the feedpoint impedance to 112 ohms (a 1 wavelength circumference helical has a feedpoint impedance of 140 ohms). This means the matching section can be 75 ohm coax (such as RG-11 or RG-59). One may wonder what effect changing the circumference from 1 wavelength to 0.8 wavelengths has. The 0.8 wavelength circumference helical has a slightly lower gain. But, by trading off this gain we not only get an easier to build matching section but also produce a slightly wider half power beam width which makes tracking a bit less critical. This comparison is shown in Table 2. If you examine the EIRP column of Table 2 you will see that a 100 watt (output) transmitter will yield much more than the required EIRP for Phase IIIB. In fact, with a 6 turn 0.8 wavelength circumference helical and a 100 watt transmitter, you

*26 Carey Ave., Watertown, MA 02172



Number of Turns=6
Spacing between Turns=0.25 wavelengths
Circumference=0.8 wavelengths
Half Power Beam Width=53 degrees
Gain=11.6 dBi

FIGURE 1



Number of Turns=6
Spacing between Turns=0.25 wavelengths
Circumference=1.0 wavelengths
Half Power Beam Width=42 degrees
Gain=13.5 dBi

FIGURE 2

could tolerate a feedline loss of 1.6 dB (10m of RG213) and still get 1 kW EIRP. Similarly, a 1 wavelength circumference helical with 6 turns would allow you to have a feedline loss of as much as 3.54 dB (23m or RG213) and still have 1 kW EIRP. To show the effects of the circumference of the radiation patterns of the antennas I have shown their calculated radiation patterns in Figures 1 and 2.

The thought of building a helical of circular cross-section for 2 meters brings to mind certain mechanical complications. There is no reason the antenna cannot be built with a square (or for that matter triangular) cross-section. This situation has been studied by Kraus and Williamson[12] and more recently in a practical study reported by Maclean[13]. These studies concluded that as long as the length of the conductor per turn (in wavelengths) remained the same, there was no noticeable difference between antennas with square, circular or triangular cross-sections. The use of a square configuration might make building a 2 meter helical easier. I have built a 3 turn square helical for 2 meters. It has easily survived a New England winter with no noticeable mechanical deterioration. An analysis of the electrical characteristics of this antenna is currently in progress. I hope to be able to report these results soon.

In Figure 3, below, I have shown the relation of gain to circumference and number of turns. This is based on the equation:

$$\text{Gain (dBi)} = 11.8 + 10 \log_{10} (C^2 nS)$$

Where C is the circumference in wavelengths, n is the number of turns and S is the spacing in wavelengths. (This equation was given by WB4VXP in his excellent 3-part article in *73* Magazine.[14]) Examining Figure 3 one sees that as the number of turns increases, the gain does not always increase at the same rate. For example, for C = 1 wavelength, 5 turns represents a gain of 12.7 dBi; adding 5 more turns increases the gain by about 3 dB. Adding 5 more turns increases the gain only about 1.8 dB. Increasing a 30 turn helical to 35 turns increases the gain by only 0.8 dB. Thus, one might prefer to use a different helical configuration rather than merely add turns. One of these other configurations consists of mounting 4 helicals in a square on a common, large reflector. This design was published by K6UQH in *QST*,[15] it looks like a natural for Mode L. Another method of increasing gain that shows promise for Mode L is called the helicone. This antenna, developed by

MHz	Inches	Centimeters
146	0.485 to 4.04	1.23 to 10.26
436	0.162 to 1.35	0.41 to 3.44
1269	.056 to 0.47	0.14 to 1.18

Table I — Helical conductor diameters.

Circumference (wavelengths)	Gain (dBi)	½ power (degrees)	EIRP for 100 W input to antenna
0.8	11.6	53	1452
1.0	13.5	42	2269

Table 2 — Comparison of six turn, 0.25 wavelength spacing helical antennas.

Carver,[16] mounts a single helical in a conical horn with a mouth diameter of 3.2 wavelengths. It raises the gain of a 10 turn helical from 15.7 dBi to 19 dBi. Both the 4 bay helical array and the helicone might prove useful alternatives to 30 turn helicals or circular fed, 1-meter parabolic dishes that have been suggested for Mode L.

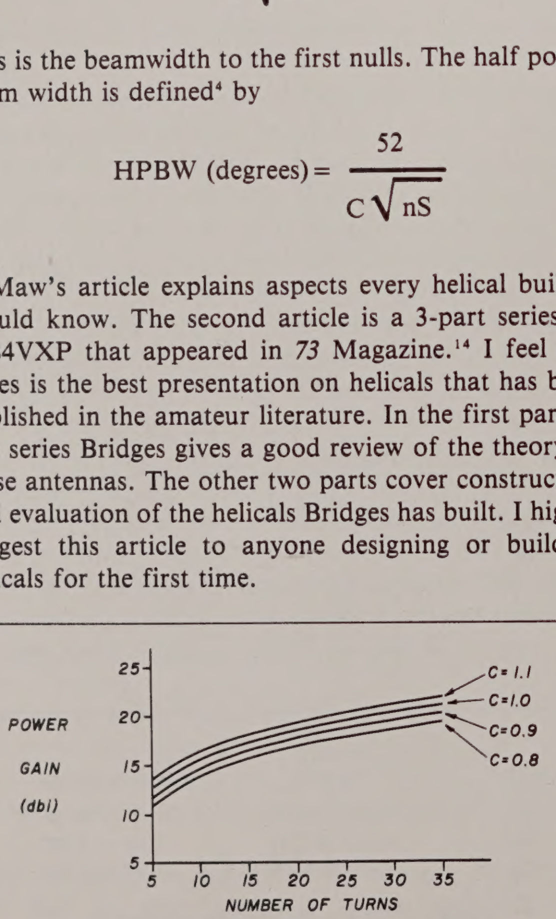
If you plan on building some helicals, I would suggest two other articles besides the previously mentioned articles by WD4FAB. The first is DeMaw's article in November 1965 *QST*.[9] Please note that on page 25 of DeMaw's article the beamwidth of a helical in degrees is stated as

$$\frac{115}{C\sqrt{nS}}$$

This is the beamwidth to the first nulls. The half power beam width is defined[4] by

$$\text{HPBW (degrees)} = \frac{52}{C\sqrt{nS}}$$

DeMaw's article explains aspects every helical builder should know. The second article is a 3-part series by WB4VXP that appeared in *73* Magazine.[14] I feel this series is the best presentation on helicals that has been published in the amateur literature. In the first part of this series Bridges gives a good review of the theory of these antennas. The other two parts cover construction and evaluation of the helicals Bridges has built. I highly suggest this article to anyone designing or building helicals for the first time.



HELICAL ANTENNA GAIN BASED ON CIRCUMFERANCE AND NUMBER OF TURNS
(SPACING BETWEEN TURNS = 0.25 WAVELENGTHS)

FIG. 3

Even though not directly related to helicals, I would like to cover two other points. As mentioned by WD4FAB in his article,[3] use good feedline if you are building antennas for 70 cm or 23 cm. RG58 will not suffice on 70 cm and above. Use Heliax or hardline if you can. If not, use the shortest length of a good quality MIL grade flexible coax like RS-213/U.

Second, if you build your own 70 cm and 23 cm antennas, use a good SWR bridge or directional wattmeter. Do not use the 'magic box' SWR bridges so common on hf and 2 meters. They will not work in the uhf region! Generally, their directivity seriously deteriorates at uhf making them worse then useless. The use of a good directional wattmeter (such as those made by Bird, Dielectric Communications, and others) will ease the adjustment of your uhf antennas for best performance.

I have included a bibliography of helicals not footnoted. This bibliography covers articles on more advanced design and analysis techniques for various helical arrays. These publications should be available at any good university engineering library.

I hope that this article has presented some useful ideas on helicals and will help you in your preparation for Phase IIIB.

References

1. Jansson, Dick WD4FAB; "70 Cm Satellite Antenna Techniques," *Orbit* Vol. 1, No. 1, March 1980, pages 24-26.
2. Jansson, Dick WD4FAB; "Helical Antenna Construction for 146 and 436 MHz," *Orbit* Vol. 2, No. 3, May/June 1981, pages 12-15.
3. Jansson, Dick WD4FAB; "A Q&A About Helical Antennas," *Orbit*, Vol. 3, No. 2, March/April 1982, pages 8-9.
4. Kraus, John W8JK; *Antennas*, McGraw-Hill Book Co, New York, 1950, page 210 (Chapter 7 of this book is the best reference on the basic helical antenna. The book in general is the bible of all antenna engineers.)
5. NASA Tech Brief 70-10016, National Aeronautics and Space Administration (reprinted in *QST*, June 1972, page 47).
6. Allen, Bill W7US; "A Mode J Helix," *AMSAT Newsletter*, Vol. XII, No. 2, June 1979, pages 30-31.
7. Cadwallader, Joe K6ZMW; "Easy 50 ohm Feed for a Helix," *QST*, Vol. LXV, No. 6, June 1981, pages 28-29.
8. Kraus, John; "A 50-Ohm Input Impedance for Helical Beam Antenna," *IEEE Transactions on Antennas and Propagation*, Vol. AP-25, No. 6, Nov. 1977, page 913.
9. DeMaw, Doug W1CER; "The Basic Helical Beam," *QST*, Nov. 1965, pages 20-25, 170.
10. Stegen, R.J.; "Impedance Matching of Helical Antennas" (communications, *IEEE Transactions on Antennas and Propagation*, January 1964, pages 125-126.
11. Mallozzi, D.M. N1DM; "The Tailored Helical," *AMSAT Newsletter, Vol. X, No. 1, March 1978, pages 8-9.*
12. *Kraus, J.D. & Williamson, J.C.; "Characteristics of Helical Antennas Radiating in the Axial Mode," Journal of Applied Physics,* Vol. 19, Jan. 1948, pages 87-96.
13. Maclean, T.S.M.; "Measurements on high-gain helical aerial and on helical aerials of triangular section," *Proc. IEE (London)*, Vol. 111, No. 7, July 1964, pages 1267-1270.
14. Bridges, A.L.; "Really Zap OSCAR with this Helical," (in 3 parts), *73* Magazine, July 1975 (pages 59-64), August 1975 (pages 12-20), Sept. 1975 (pages 83-88). This series includes an extensive list of references.
15. K6UQH; "A Quadhelix Antenna for 1215 MC," *QST*, Aug. 1963, page 63 (see also feedback *QST*, Dec. 1972, page 88).
16. Carver, K.R.; "The Helicone—A Circularly Polarized Antenna with Low Side Lobe Level" (Proceedings letters), *Proc. IEEE*, April 1967, pages 558-559.

Additional Bibliography of Information on Helical Antennas

The following bibliography lists further references not footnoted in this article. I have included a brief description of the content of the article.

1. Brier & Orr; *VHF Handbook for Radio Amateurs;* Radio Publications Inc., Wilton, Conn.; 1975; pages 286-287: These pages present the design of a helix for 2 meters. It uses a circumference of 0.9 wavelengths, apparently to reduce the effects of SWR.

2. Evans & Jessop; *VHF-UHF Manual (3rd Ed.)*; RSGB; Longon; 1976; pages 7.21-7.22: Presents designs of various helicals for 2M, 70 cm, and 23 cm. Includes some thoughts on mechanical configuration.

3. Orr: *Radio Handbook (21st Ed.)*; Editors and Engineers; Indianapolis; 1978; pages 30.17-30.20: Information on a 2 meter helical.

4. Wong & King; "Broadband Quasi-Taper Helical Antenna," *IEEE Transactions on Antennas and Propagation*; Vol. AP-27, No. 1, Jan. 1979; pages 72-78: This article presents results of various methods of increasing the bandwidth of helicals.

5. Letter describing a receiving antenna for 137 MHz weather satellites, by Ruperto. *Scientific American*; Dec. 1975, pages 122-125: Some thoughts on construction of antenna and matching transformer.

6. Kraus; "Helical Beam Antenna for Wide Band Applications," *P.I.R.E.*; Oct. 1948; pages 1236-1242: A classic paper which includes variations such as a 4 bay high gain array and a helix of square cross-section.

7. Glasser & Kraus; "Measured Impedances of Helical Beam Antennas," *Journal of Applied Physics*; Vol. 19, Feb. 1948; pages 193-197: Results of various experiments on parameters that effect feedpoint impedance.

8. Green; "Parabolodial Reflector Aerial with a Helical Feed," *Proceedings of the I.R.E. Australia*; Feb. 1960; pages 71-83: This article may be of interest to you wishing to build a circular feed for a parabolic for 1269 MHz.

9. King & Wong; "Gain and Pattern Characteristics of 1 to 8 Wavelength Uniform Helical Antennas," *1978 IEEE Antennas and Propagation Symposium Proceedings*; pages 69-72: Presents graphs on the measured performance of cavity backed helical antennas.

10. Angelakos & Kajfez; "Modifications on the Axial Mode Helical Antenna" (letter), *Proc. IEEE*; April 1967; pages 558-559: Reports on using tapered feeds to improve the SWR and pattern characteristics of a helix.

11. Richards; "The Chopstick Helical," *Orbit*; Vol. 2, No. 1, Jan./Feb. 1981; pages 8-9: A 15 dB gain 435 MHz antenna using RG58 for the element is described.

Comets

AMSAT's Annual General Meeting:

Packet Radio group meeting. Rear: W3IWI, W3OTC, KA9Q, KD2S, WB9FLW, K8MMO, W4RI. Seated: K3NA, WB4JFI, WA7GXD, KA6M.

W9KDR reports on ARNET and STS-9.

KA6M discusses AMICON and PACSAT Packet Radio concepts.

W4PUJ describes a slide as part of a presentation.

Improving Mode-A Station Performance

By Ray Soifer, W2RS*

The launch of recent Soviet Amateur Radio satellites has rekindled interest in Mode A among the world's satellite enthusiasts. Even after the hoped-for success of AMSAT's Phase IIIB, Mode A interest is likely to continue as long as these satellites, and AMSAT-OSCAR 8, remain operational. Mode A equipment is inherently simpler and less expensive than Modes B and J. Moreover, contacts made through Phase III satellites will not count for most operating awards while those made through Phase II satellites will continue to count even after Phase IIIB becomes operational.

The minimum QSO requirements using 2-meter uplink and ten-meter downlink are absurdly simple. Utilizing vacant overhead passes, the author has heard himself on a converted CB walkie-talkie while transmitting on a two-meter hand-held, using only the telescoping whip antennas which came with the units. Much you have read about how easy it is to get on Mode A is true. This article, however, is not directed at the first-time user, but at the reader who has already put together a working satellite station for Mode A and is now seeking to improve its performance.

The following scene occurs during nearly every orbit which I operate: A station is heard, frequently with a strong signal, calling CQ. I reply to his call, on his frequency, with a downlink signal of about the same strength. The station called either cannot hear me or comes back with a signal report far lower than I give him. Upon inquiry, I discover that the station is using well above the ''recommended'' level of 100 W effective radiated power, but that his ten-meter receiving setup leaves substantial room for improvement.

Mode A has many factors in common with Mode J. It's fairly easy to put together a downlink receiving system for either mode which will produce a few contacts under ideal conditions. However, optimizing one's receiving station to squeeze out the most possible communication from the satellite is, in either J or A, a continuing process. A dB here, a fraction of a dB there, they all add up, at 29 MHz as well as at 435 MHz.

Your Receiver

Satellite downlink signals on Mode A are frequently very weak. At 29 MHz the ambient antenna noise level in a 3 kHz bandwidth is typically around −120 dBm, or about 0.2 microvolts. The satellite downlink signals themselves are often comparable in strength particularly when the satellite is heavily loaded or at low elevation angles. It is therefore necessary to assure that the receiver is capable of delivering satisfactory performance with signals in this amplitude range.

Many older receivers are simply not up to the job without a simple preamplifier. For example, a typical receiver sensitivity specification of ten years ago was 0.5 microvolts for 10 dB signal-plus-noise-to-noise. While some modern receivers do claim sensitivity in the range of 0.2 microvolts, it should be recognized that their actual performance may not equal their claimed specifications in all cases. In particular, it is usually necessary to realign the receiver's tuned circuits to optimize performance at 29.45 MHz rather than in the 28.5 MHz range where most receivers are usually peaked. Suitable preamplifiers are available from commercial suppliers. Look at the ads in any recent issue of *QST*. An excellent, widely-duplicated circuit by Jack Colson, W3OZ (ex-W3TMZ), holder of the first Satellite WAS (Jack's award was issued by AMSAT, since ARRL OSCAR WAS did not yet exist), appeared in the July 1975 issue of *73 Magazine*.

Your Feedline and Antenna Tuner

That's right, it says ''antenna tuner.'' At ten meters, impedance matching and SWR are usually not very important for *transmitting* purposes unless the line is unusually long or lossy, since transmitted power reflected by the antenna is re-reflected at the transmitter. On receive, however, any signals reflected at the junction between antenna and feedline, or that between feedline and receiver, are reflected back toward the antenna and re-radiated into space. It is thus critically important that the feedline be properly matched to the

---

**60 Waldron Ave. Glen Rock, NJ 07452*

antenna and that the receiver be properly matched to the feedline. Receivers rarely exhibit the 50-ohm imput impedance they claim. If your receiver has an adjustable front-end tuned circuit (often labeled "antenna trimmer" or something similar), this should be carefully adjusted for maximum power transfer (as indicated by 'S'-meter reading) at 29.45 MHz. An antenna tuner is often extremely helpful. Bear in mind, however, that if the tuner is adjusted to optimize the performance of your transmitter, the same setting may *not* be best for your receiver. For satellite use, the tuner should be adjusted for greatest received signal strength. A low pass filter may also be helpful in cases of receiver desense while the two-meter transmitter is on. In both cases (tuner and filter) be alert to losses introduced by "el cheapo" models. You may wind up losing more than you gain! Watch especially the filter rolloff (attenuation) at 29 MHz. Some filter's slope begins at 28 or 29 MHz. You could lose a dB or two right there.

Your Antenna

More misleading information has probably been printed about antennas for ten-meter satellite operation than any other OSCAR-related subject. As mentioned earlier, just about any antenna will produce some signals particularly when the satellite is close or when signals are strong. Strong signals heard under such conditions may serve to convince the user his installation is better than it really is. The real test comes later.

A Soviet "RS-series" satellite will be below 30 degrees elevation approximately 80 percent of the time it's "visible" from your station. It will be below 10 degrees elevation approximately 50 percent of the time. AMSAT-OSCAR 8, with its lower altitude, will be below these elevation angles even *more* of the time. It is therefore imperative that your ten-meter antenna deliver its best performance at low elevation angles. This is even more important at times when ionospheric absorption or auroral flutter reduce low-angle signal strength. It cannot be said too often or too strongly that the best antenna for ten-meter satellite work is a beam mounted at least one wavelength above ground and pointing at the horizon. Do not worry about loss of signal at higher angles of elevation. The satellite is above 30 degrees elevation less than 20 percent of the time it is in range and then the reduced distance will compensate for the signal strength lost by the misaimed antenna. The two-meter uplink antenna, if it is directive enough, may be elevated to follow the satellite, but the ten-meter beam should be left to point toward the horizon.

As an example of how some users are not hearing what they should because of their antennas, consider the much-publicized crossed-dipoles-over-ground-screen antenna, with the dipoles ¼ wavelength above the screen. At 30 degrees elevation, such an antenna produces a "gain" of -2.5 dBi; at 10 degrees, a "gain" of -10 dBi. At zero degrees elevation, its response is theoretically nil. Such an antenna is intended to produce circular polarization at high angles of incidence. At the horizon, its polarization is entirely horizontal rather than circular. At ten degrees elevation, the difference between such an antenna and a good, three-element Yagi is 20 dB in received signal strength—the difference between hearing signals and not hearing them.

When choosing a ten-meter beam, particular attention should be paid to its usable bandwidth. Presumably, you will want to use the antenna in the normal cw and phone bands as well and it is the rare tribander indeed which can deliver this type of bandwidth—flat response between 28.00 and 29.50 MHz. The author uses a three-element Wilson monobander. Ben Stevenson, W2BXA, holder of Satellite DXCC No. 1, hears better than I do and uses a four-element Telrex monobander mounted thirty feet higher than mine.

Your Neighborhood

Earlier, we observed that the typical level of antenna noise at 29 MHz is about -120 dBm. This noise is primarily cosmic in origin. Many amateurs, however, live in areas which have ambient noise levels far higher than this. Such noise is usually man-made. What man makes, man can stop making! The most common type of man-made noise which afflicts Mode A satellite operation is that resulting from leaky power lines—broken insulators, lightning arrestors, defective transformers, downed wires, contact with trees and other objects. All of these (and more) are capable of wiping out the satellite's signal at your station. Power leaks need not be close to cause trouble; those a mile or more away can be responsible for serious problems.

W2BXA, and Jack Lee, W3CWG, introduced the author to a technique which all of us have found extremely helpful in pinpointing the sources of such interference. First, the general area is identified with the ten-meter beam and by driving about with an AM broadcast radio. The latter, by itself, may give misleading results because of radiation from power lines, so should not be relied upon solely. Once the general area has been identified, a VHF AM or ssb receiver should be used, preferably with some sort of directional antenna such as a DF loop or a small beam. An old two-meter portable AM receiver, an aircraft radio receiver, or even a very cheap high-band FM receiver without limiting action have all been used satisfactorily. Good quality FM receivers such as those found in amateur two-meter hand-helds will not work because of their limiting circuits. Walk around the suspected area taking directional bearings on the noise at VHF. Generally this technique will be able to identify the specific power pole or other source of noise. Occasionally, a higher frequency such as 450 MHz is required.

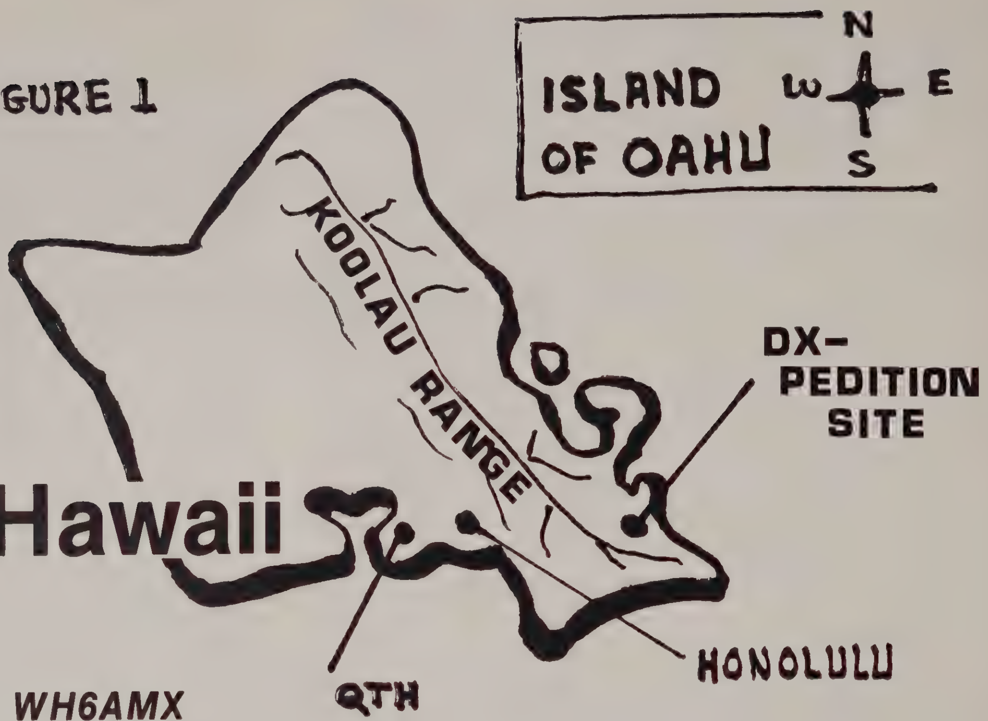
Once the specific source is identified the power company or other responsible agency may be contacted. Our experience has been that local utilities, if approached politely with this sort of information and willingness to help, are happy to remedy the condition. After all, it's

(Continued on page 18)

WAS-50 From Hawaii

By Rick G. Dittmer,* WH6AMX

FIGURE 1



Making Satellite W.A.S. in itself is a significant achievement; achieving this award from the state of Hawaii is another story. Consider the fact that the closest state (not counting Hawaii) is 2,400 miles away and that the furthest state is 5,100 miles away!

My quest for Satellite Worked All States Award was not really seriously considered until a successful contact was made with Dr. Tom Clark, W3IWI, on 10 January 1982 through the Russian Amateur Satellite RS-8. This first contact with the East Coast (specifically Maryland) opened many new possibilities. The capabilities of the new born "RS" satellites were beginning to be realized.

The first few months after the WH6AMX/W3IWI QSO, schedules were made at the request of many East Coast stations. These schedules and ultimate contacts satisfied mutual needs of both stations and I was able to pick up many needed states. But, along with these schedules a problem began to surface. For some reason, I was having difficulty with states on the East Coast—north of New Jersey at satellite elevations less than ten degrees above my horizon. It was determined that my window to the East-Northeast was effectively being blocked by the Koolau Mountain Range (see Fig. 1) from 60 to 360 degrees antenna azimuth. It was because of this situation that I would have to go portable across the mountain range to the East side of Oahu if I was to successfully work the New England States.

After reviewing satellite pass information in the Orbital Prediction Calendar, it was determined that my first attempt at the East Coast states would be made during the period from 13 April 1982 to 16 April 1982. The target states for the DXpedition would be Connecticut (W1NU), Delaware (K3JL), Massachusetts (WA1ZUB), Maine (W1WM), New Hampshire (W1JSM), Rhode Island (K1DS), and Vermont (K1LJL). With the expert coordination of Ray Soifer, W2RS, who was very instrumental in organizing the East Coast stations, the DXpedition was on.

On the 13th of April, a site was set up at Waimanalo (see Fig. 1 DXpedition site) for Mode A operation through the RS satellites. The equipment set up for the DXpedition included a Kenwood TS700SP 2 meter transceiver with a Mirage 160 watt amplifier into a 10 element twist antenna for transmit. The receive side included a Heathkit SB104A Transceiver into an Ameco PT2 Preamplifier into a 10 meter sloping dipole. The entire set up was erected on an ocean front site about 20 feet from the beach.

The first two days of the DXpedition were plagued with powerline noise which made the scheduled contacts impossible. Powerline noise seems to be a common nuisance where salt content in the air is high. The salt causes corrosion on the powerline insulators thus causing electrical arcing. The only quick cure for this problem was to have a good rain shower. On the 15th of April my prayers were answered. It rained that day and the frequency was finally clear. At 0905 UTC, RS-8 came above the horizon and at 0911 UTC the first signals were heard from the East Coast. The first contact was with John, K3JL of Delaware followed shortly thereafter by Vic, W1NU of Connecticut, Steve, K1LJL of Vermont, and Jim, WA1ZUB of Massachusetts. The pass was very prosperous indeed! I had accomplished the two scheduled contacts as well as working two other

*7505D Aloalo Street, Honolulu, HI 96818 stations a day earlier than they were scheduled. This allowed me to concentrate extra time on the remaining station—Rick, K1DS of Rhode Island. At this point, Maine and New Hampshire were clearly missed and I would have to set up another DXpedition for these two states. The satellite track was too far west for a window with Maine and New Hampshire.

On April 16th, the final day of the DXpedition, the powerline noise was back but it was intermittent. Again at approximately 0900 UTC the East Coast signals were being heard through the RS transponder and Rick, K1DS, was worked with little difficulty. The first DXpedition had proven to be a success with five out of seven states worked. Maine and New Hampshire would be worked at a later date.

The next few months were filled with schedules working the states that were readily accessible from the WH6AMX home QTH. These included states that were needed in the Southeast United States, Southern and Midwest States as well as some Western States. In June of 1982 it was realized that I was approaching the number 48 mark in confirmed states so again, I went to the Oribtal Prediction Calendar to determine a time frame for DXpedition -2.

The DXpedition period was set for 9 August 1982 through 13 August 1982. At this point, careful planning was used to select the best possible station locations in Maine and New Hampshire for the attempts. Jim Buckley, WA1ZUB, graciously and enthusiastically volunteered his services as my East Coast coordination manager. He soon had stations from Maine and New Hampshire scheduled for the DXpedition period. These stations included from Maine, Dave Olean, K1WHS; Bob Thompson, W1WM; and Mike Roper, K0QJK/1. Dave, K1WHS, an avid EME enthusiast had set up especially for this operation. He was not a satellite operator to this point. From New Hampshire, the stations that were scheduled were Don Brown, W1JSM and Ted Gamlin, K1OX.

Jim, WA1ZUB, kept all stations supplied with up-to-date computer readouts of the satellite parameters during the DXpedition and Vic Politi, W1NU, made up special tracking devices for all stations involved in the operation.

While preparations were being made on the East Coast, it was determined in Hawaii that some changes would be made to improve the chances for success. One of these changes included changing receiving antennas. This second attempt would be using a higher gain antenna than the sloping dipole used in the first. A 3 element yagi was selected. Other than this change all other equipment set up would remain the same as the first DXpedition.

All was in order and on 9 August 1982, another beachfront site was selected in Waimanalo and the second DXpedition was underway. On the 10th of August the first schedule was set for Maine. At 0813 UTC, K1WHS was heard but he did not respond to my reports. The RS-6 satellite fell below the horizon shortly thereafter leaving the first scheduled contact unaccomplished. It was realized after the first pass that the conditions were not as enhanced during the evening as they were during the first DXpedition. On the 11th of August, RS-8 rolled into range but this time no stations were heard. Things were getting anxious. If the contact with Maine was not made on the next day, the satellite would be too far west for a window between Maine and Hawaii. After reviewing the orbital data, it was noted that a daytime pass was available on RS-6 that had possibilities. It was also noted that daytime passes seemed to be more enhanced than the evening passes. So a phone call to K1WHS was made and the daytime pass was attempted. On August 11th at 2116 UTC, a successful contact was completed between K1WHS (Maine) and WH6AMX for a distance of 5,190 miles. The window was approximately 30 seconds long—just enough time to exchange reports. The hardest part was over, that of working the furthest state from my location. All that remained was New Hampshire.

WH6AMX

On the 12th of August, RS-8 popped above the horizon and shortly after, a successful contact was made with Don Brown, W1JSM, making state number 50 and a successful conclusion to a hard sought after achievement.

The first Satellite Worked All States Award from Hawaii was confirmed on the first of September 1982 with Award Number 73—an appropriate number to all the stations that worked so hard and stayed up to unGodly hours to help me achieve this goal. My special thanks go to Ray Soifer, W2RS, and Jim Buckley, WA1ZUB for their undying support and coordination efforts as well as Vic Politi, W1NU, for taking the time and initiative to make up the tracking devices. These gentlemen really made the achievement a reality.

AMSAT Bulletin Board System

By Robert J. Diersing,* N5AHD

A basic "how-to-use" guide to this vital information bank.

By now, many ORBIT readers have heard about the AMSAT Bulletin Board System through one source or another. Many have already used and become familiar with the system. This article has been prepared to answer questions that have been raised about how to configure hardware and software as well as how to access the system. For those who have written N5AHD asking for information about the system, we hope this article provides the answers.

The idea of using a microcomputer with the appropriate telephone line interface as a message collection and distribution system is not new. There are probably hundreds of similar systems existent. Some are general purpose systems while others specialize in communications specifically related to topical areas. The AMSAT system serves those interested in satellite-related topics. The main advantage of computerized bulletin board system likely is that of convenience. Once one is accustomed to the operation of the system, messages can be entered at any convenient time and they may be likewise retrieved at any time.

Purpose and History

The purpose of the AMSAT Bulletin Board System is to provide a quick and efficient means of communicating information related to the amateur satellite program. There is no charge for usage (except for your telephone call) and there is no limit on the number of times you may call in.

The need for the system became apparent when, at the end of 1981, there was a long interval when no orbital data (in the form of Keplerian element sets) was available in any of the usual places.

This may seem like a small point upon which to begin such an ambitious endeavor, but the solution of a small problem often helps avert larger ones. The ability to communicate, or perhaps the lack of ability to communicate, is the point addressed here. Several months before I noted the problem with obtaining orbital data, I had already been working on a bulletin board program for my computer system. All it really lacked to be usable, I thought, was a method to record some information about the users who logged on the system for the first time. So the code was written, the system was advertised, and things were off and running.

Usage

Even though the system could be much more refined in its operation than it is, there has been a very good response from satellite enthusiasts. Since the time of bringing the system online until now, there have been over 100 successful users and nearly 400 messages have passed through the system. Once some of the questions about access and equipment have been answered, it is likely usage will further increase.

Example Messages and Files

Before a detailed discussion of hardware, software, and procedures is begun, perhaps examples of some of the data that can be accessed on the system would be helpful.

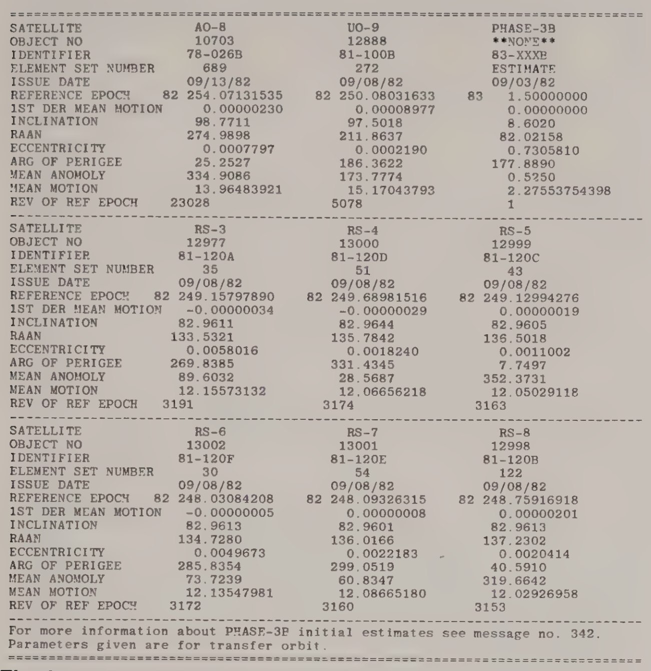
1. Orbital element sets for all operating satellites are available on the system in the form of information files. (Fig. 1)
2. Message No. 64 thru 78 are typical of the timely data that is entered into the system. As a matter of fact, message No. 64 was entered two days before the same data was available thru any regularly scheduled AMSAT net. (Fig. 2)
3. Message No. 341 thru 342 present most current data about the Phase-IIIB launch and orbital elements. (Fig. 3)

Equipment Required

Even though access to bulletin board systems such as the AMSAT system is easy, information about how to do it has not previously been available in an AMSAT publication. When one desires to access the system, the

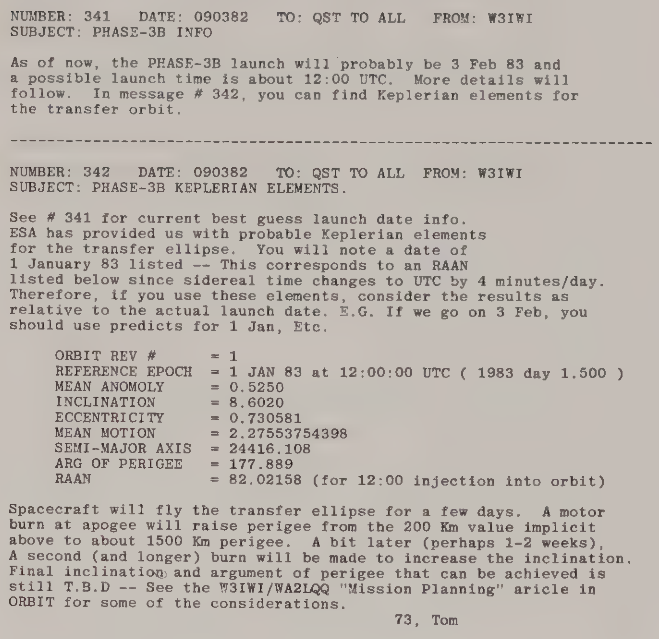
---

*Director of Computer Services, Corpus Christi State University



```
==========================================================================
SATELLITE               AO-8               UO-9              PHASE-3B
OBJECT NO               10703              12888             **NONE**
IDENTIFIER             78-026B            81-100B            83-XXXB
ELEMENT SET NUMBER      689                272               ESTIMATE
ISSUE DATE             09/13/82           09/08/82           09/03/82
REFERENCE EPOCH     82 254.07131535    82 250.08031633    83   1.50000000
1ST DER MEAN MOTION     0.00000230         0.00008977          0.00000000
INCLINATION            98.7711            97.5018             8.6020
RAAN                   274.9898           211.8637            82.02158
ECCENTRICITY            0.0007797          0.0002190           0.7305810
ARG OF PERIGEE          25.2527           186.3622           177.8890
MEAN ANOMOLY           334.9086           173.7774             0.5250
MEAN MOTION             13.96483921        15.17043793          2.27553754398
REV OF REF EPOCH     23028              5078                   1
--------------------------------------------------------------------------
SATELLITE               RS-3               RS-4               RS-5
OBJECT NO              12977              13000              12999
IDENTIFIER            81-120A            81-120D            81-120C
ELEMENT SET NUMBER      35                 51                 43
ISSUE DATE            09/08/82           09/08/82           09/08/82
REFERENCE EPOCH    82 249.15797890    82 249.68981516    82 249.12994276
1ST DER MEAN MOTION   -0.00000034        -0.00000029          0.00000019
INCLINATION           82.9611            82.9644             82.9605
RAAN                 133.5321           135.7842            136.5018
ECCENTRICITY           0.0058016          0.0018240           0.0011002
ARG OF PERIGEE       269.8385           331.4345              7.7497
MEAN ANOMOLY          89.6032            28.5687            352.3731
MEAN MOTION           12.15573132        12.06656218         12.05029118
REV OF REF EPOCH   3191               3174               3163
--------------------------------------------------------------------------
SATELLITE               RS-6               RS-7               RS-8
OBJECT NO              13002              13001              12998
IDENTIFIER            81-120F            81-120E            81-120B
ELEMENT SET NUMBER      30                 54                 122
ISSUE DATE            09/08/82           09/08/82           09/08/82
REFERENCE EPOCH    82 248.03084208    82 248.09326315    82 248.75916918
1ST DER MEAN MOTION   -0.00000005         0.00000008          0.00000201
INCLINATION           82.9613            82.9601             82.9613
RAAN                 134.7280           136.0166            137.2302
ECCENTRICITY           0.0049673          0.0022183           0.0020414
ARG OF PERIGEE       285.8354           299.0519             40.5910
MEAN ANOMOLY          73.7239            60.8347            319.6642
MEAN MOTION           12.13547981        12.08665180         12.02926958
REV OF REF EPOCH    3172               3160               3153
--------------------------------------------------------------------------
For more information about PHASE-3B initial estimates see message no. 342.
Parameters given are for transfer orbit.
==========================================================================
```

Fig. 1



```
NUMBER: 341   DATE: 090382   TO: QST TO ALL   FROM: W3IWI
SUBJECT: PHASE-3B INFO

As of now, the PHASE-3B launch will probably be 3 Feb 83 and
a possible launch time is about 12:00 UTC.  More details will
follow.  In message # 342, you can find Keplerian elements for
the transfer orbit.

----------------------------------------------------------------

NUMBER: 342   DATE: 090382   TO: QST TO ALL  FROM: W3IWI
SUBJECT: PHASE-3B KEPLERIAN ELEMENTS.

See # 341 for current best guess launch date info.
ESA has provided us with probable Keplerian elements
for the transfer ellipse.  You will note a date of
1 January 83 listed -- This corresponds to an RAAN
listed below since sidereal time changes to UTC by 4 minutes/day.
Therefore, if you use these elements, consider the results as
relative to the actual launch date. E.G. If we go on 3 Feb, you
should use predicts for 1 Jan, Etc.

     ORBIT REV #       = 1
     REFERENCE EPOCH   = 1 JAN 83 at 12:00:00 UTC ( 1983 day 1.500 )
     MEAN ANOMOLY      = 0.5250
     INCLINATION       = 8.6020
     ECCENTRICITY      = 0.730581
     MEAN MOTION       = 2.27553754398
     SEMI-MAJOR AXIS   = 24416.108
     ARG OF PERIGEE    = 177.889
     RAAN              = 82.02158 (for 12:00 injection into orbit)

Spacecraft will fly the transfer ellipse for a few days.  A motor
burn at apogee will raise perigee from the 200 Km value implicit
above to about 1500 Km perigee.  A bit later (perhaps 1-2 weeks),
A second (and longer) burn will be made to increase the inclination.
Final inclination and argument of perigee that can be achieved is
still T.B.D -- See the W3IWI/WA2LQQ "Mission Planning" aricle in
ORBIT for some of the considerations.
                                            73, Tom
```

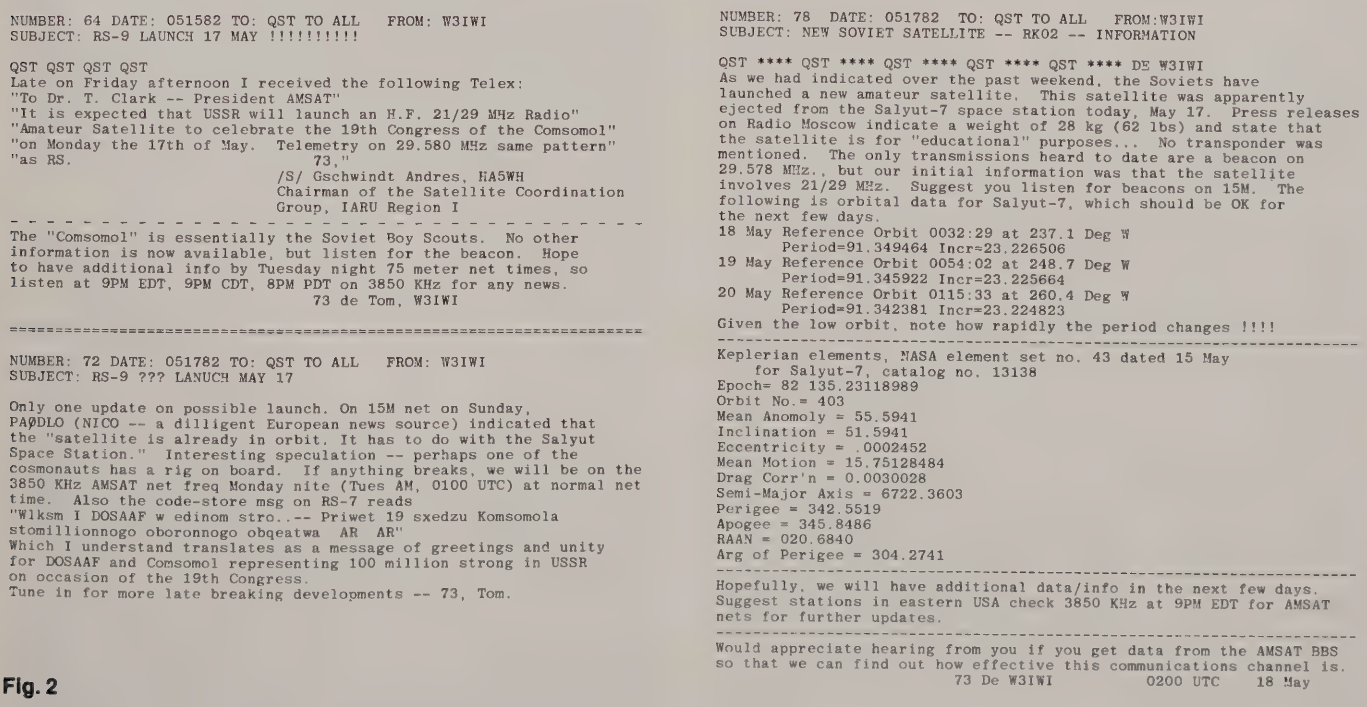
Fig. 3

hardware and software on the user's end must first be considered. There are several possibilities:

1. The user has a terminal and a modem. The modem may be of the acoustic coupler variety or the direct-connect type. This is the simplest case. For some types of terminals, the modem may be built into the terminal itself.
2. The user has a computer to which a terminal is attached and has a modem attached to the computer. This connection is typically made through an RS-232C serial port of the computer.
3. The user has a computer to which a terminal is attached and has a modem as an integral part of the computer.

For the second and third cases, there is the additional aspect of software to consider because the modem may or may not require software to control its functions. To answer all the equipment questions for the general case will be difficult at best. Let's consider the simplest case first.

In the case of the user who has only a terminal and modem, I prefer the direct-connect type of modem to



```
NUMBER: 64 DATE: 051582 TO: QST TO ALL   FROM: W3IWI
SUBJECT: RS-9 LAUNCH 17 MAY !!!!!!!!!!

QST QST QST QST
Late on Friday afternoon I received the following Telex:
"To Dr. T. Clark -- President AMSAT"
"It is expected that USSR will launch an H.F. 21/29 MHz Radio"
"Amateur Satellite to celebrate the 19th Congress of the Comsomol"
"on Monday the 17th of May.  Telemetry on 29.580 MHz same pattern"
"as RS.                             73,"
                            /S/ Gschwindt Andres, HA5WH
                            Chairman of the Satellite Coordination
                            Group, IARU Region I
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
The "Comsomol" is essentially the Soviet Boy Scouts.  No other
information is now available, but listen for the beacon.  Hope
to have additional info by Tuesday night 75 meter net times, so
listen at 9PM EDT, 9PM CDT, 8PM PDT on 3850 KHz for any news.
                                73 de Tom, W3IWI

=================================================================

NUMBER: 72 DATE: 051782 TO: QST TO ALL   FROM: W3IWI
SUBJECT: RS-9 ??? LANUCH MAY 17

Only one update on possible launch. On 15M net on Sunday,
PAØDLO (NICO -- a dilligent European news source) indicated that
the "satellite is already in orbit. It has to do with the Salyut
Space Station."  Interesting speculation -- perhaps one of the
cosmonauts has a rig on board.  If anything breaks, we will be on the
3850 KHz AMSAT net freq Monday nite (Tues AM, 0100 UTC) at normal net
time.  Also the code-store msg on RS-7 reads
"Wlksm I DOSAAF w edinom stro..-- Priwet 19 sxedzu Komsomola
stomillionnogo oboronnogo obqeatwa  AR  AR"
Which I understand translates as a message of greetings and unity
for DOSAAF and Comsomol representing 100 million strong in USSR
on occasion of the 19th Congress.
Tune in for more late breaking developments -- 73, Tom.
```

```
NUMBER: 78  DATE: 051782  TO: QST TO ALL   FROM:W3IWI
SUBJECT: NEW SOVIET SATELLITE -- RK02 -- INFORMATION

QST **** QST **** QST **** QST **** QST **** DE W3IWI
As we had indicated over the past weekend, the Soviets have
launched a new amateur satellite.  This satellite was apparently
ejected from the Salyut-7 space station today, May 17.  Press releases
on Radio Moscow indicate a weight of 28 kg (62 lbs) and state that
the satellite is for "educational" purposes...  No transponder was
mentioned.  The only transmissions heard to date are a beacon on
29.578 MHz., but our initial information was that the satellite
involves 21/29 MHz.  Suggest you listen for beacons on 15M.  The
following is orbital data for Salyut-7, which should be OK for
the next few days.
18 May Reference Orbit 0032:29 at 237.1 Deg W
       Period=91.349464 Incr=23.226506
19 May Reference Orbit 0054:02 at 248.7 Deg W
       Period=91.345922 Incr=23.225664
20 May Reference Orbit 0115:33 at 260.4 Deg W
       Period=91.342381 Incr=23.224823
Given the low orbit, note how rapidly the period changes !!!!
-----------------------------------------------------------------
Keplerian elements, NASA element set no. 43 dated 15 May
    for Salyut-7, catalog no. 13138
Epoch= 82 135.23118989
Orbit No.= 403
Mean Anomoly = 55.5941
Inclination = 51.5941
Eccentricity = .0002452
Mean Motion = 15.75128484
Drag Corr'n = 0.0030028
Semi-Major Axis = 6722.3603
Perigee = 342.5519
Apogee = 345.8486
RAAN = 020.6840
Arg of Perigee = 304.2741
-----------------------------------------------------------------
Hopefully, we will have additional data/info in the next few days.
Suggest stations in eastern USA check 3850 KHz at 9PM EDT for AMSAT
nets for further updates.
-----------------------------------------------------------------
Would appreciate hearing from you if you get data from the AMSAT BBS
so that we can find out how effective this communications channel is.
                         73 De W3IWI          0200 UTC    18 May
```

Fig. 2

the acoustic coupler type. The direct connection eliminates data transmission problems caused by room noise or faulty response of the telephone handset. I have also noted that some direct-connect modems require that the handset be left off the hook during data transmission while others do not. I prefer ones that do not require the handset to be left off the hook but that's a matter of personal preference. Most of these devices operate by plugging the modular phone plug into them and then the telephone into it thus providing the ability to place the modem inline or bypass it for normal phone operation. There are several switches sometimes available on these devices.

1. The answer/originate switch. Sometimes clearly marked as such or sometimes marked A/O. This determines the audio tone pair used for transmission and reception of data. For operation with the AMSAT BBS the switch should be in the Originate position.

2. The full/half-duplex switch. Sometimes clearly marked or sometimes marked H/F. This determines whether or not the characters that you type will be echoed locally or echoed by the computer on the other end of the connection. For operation with the AMSAT BBS, the switch should be in the Full-duplex position.

3. On direct-connect modems there will be some sort of switch usually marked DATA/TALK to switch the modem in and out of the phone line. The use of this switch will be explained below in the logon procedure section.

Some modems also have various lamps to indicate modem status. Other than the power-on lamp, the most common indicator is the carrier-detect lamp usually marked CD. This lamp illuminates when carrier is detected from the distant end of the circuit. Most all of the modems described so far operate at any baud rate from 0-300 baud in accordance with the Bell 103 standard.

Modems which are part of the computer are very common. Among them are the PMMI and Micromodem-100 for S-100 bus systems and the Micromodem-II for the APPLE/II computer. These modems also abide the Bell 103 standard. These types of modems actually fit *inside* the computer. A small box to connect the modular phone plug is all that remains outside the computer. This box is FCC-registered device and should not be modified. To use these devices, software is required to pass data to and from the terminal through the computer memory and data ports, on the the modem and out to the telephone line. In some cases, the movement of the data to and from is the only function required of the software. More often, however, the modem will have additional features that must be controlled by software. For example, the switches that were mentioned earlier for direct connect modems may not exist at all but are replaced by programmable functions. This means that a program running in the computer that also moves the data back and forth may also have to choose between the answer or originate mode. Usually

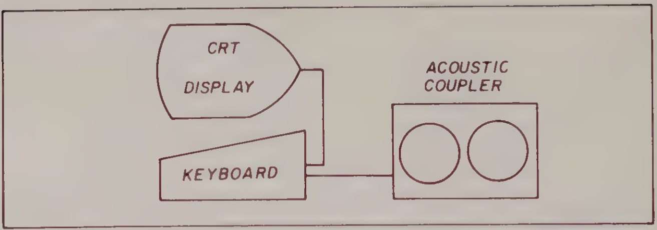


Fig. 4 — Acoustic coupler connected to terminal. Telephone handset is placed in coupler after number is dialed manually.

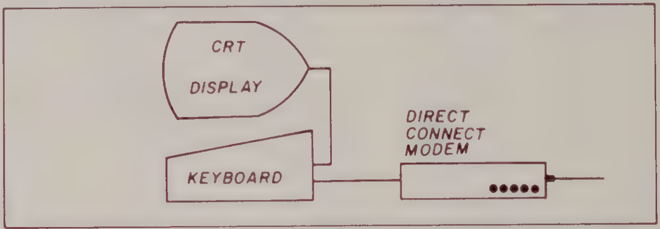


Fig. 5 — Direct-connect modem connected to terminal. Telephone line is connected to a modem via modular telephone plug. Number is usually dialed manually and then the modem is switched into the circuit for data transmission.

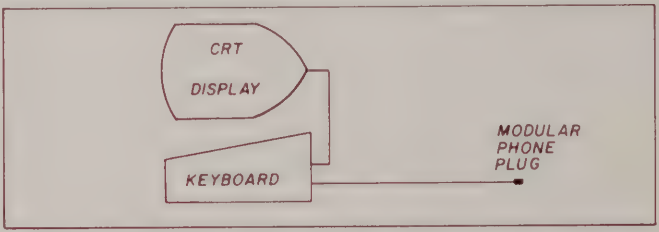


Fig. 6 — Terminal with built-in modem. Several of this type of terminal are now on the market.

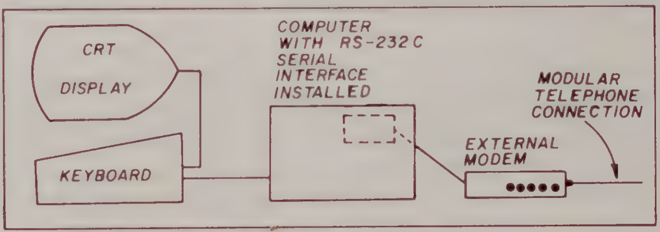

CRT
DISPLAY
KEYBOARD
COMPUTER WITH RS-232C SERIAL INTERFACE INSTALLED
MODULAR TELEPHONE CONNECTION
EXTERNAL MODEM

Fig. 7 — For a modem to be connected to an existing computer system, the system must have an RS-232C interface to which the modem is connected. A program running in the computer accomplishes the data transfer. Depending on the complexity of the external modem, it may also perform other functions such as dialing the telephone number of the bulletin board system.

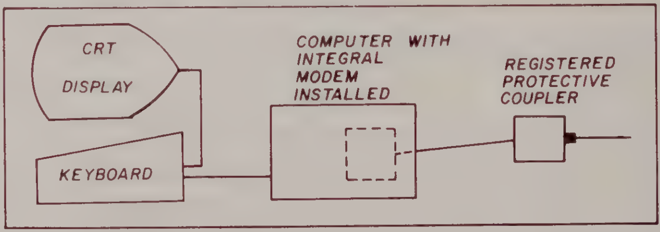

CRT
DISPLAY
KEYBOARD
COMPUTER WITH INTEGRAL MODEM INSTALLED
REGISTERED PROTECTIVE COUPLER

Fig. 8 — This installation is similar to Fig. 7 except that the modem is an integral part of the computer system. The protective coupler is supplied with the modem but is usually outside the computer itself. It is connected to the telephone circuit via a modular telephone connection.

Note: The modem and protective coupler should not be tampered with. They are registered devices and have an FCC registration number. This means that they have been certified to be compatible with telephone signaling standards and therefore will not interfere with the telephone system.

the modem manufacturer will either provide this software with the modem or supply it for a nominal fee after purchase of one of their products. I would recommend the use of manufacturer-provided software for these devices until you have your feet firmly on the ground!

The previous case can have a few variations. One possibility is to have a modem such as the UDS-103J connected to the serial port of a computer. This is a case where the modem has no programmable functions, is connected to the computer, but is *not* an integral part of the computer. Actually, it is a variation of the case where there is no computer at all. Here there is a computer between the terminal and the modem. The connection process remains the same as with the terminal and "modem only" combination but minimal software is required for movement of the data. Remember, the modem has no programmable functions.

The final case is one that has become more common in recent months and is probably the best of all worlds. This case is typified by the appearance of modems like the D.C. Hayes Smartmodem. These types of modems use a combination of features seen in the prior two cases. They are like the second case in that they connect to the computer via an RS-232C serial port. They are like the third case in that they have programmable functions that require software for proper operation of both control functions as well as data transmission.

What has happened is that manufacturers need to get more mileage out of their products. If you recall that modems that interface to a particular computer were mentioned earlier, you realize that this limited them to a particular model or bus structure. Since most computers have serial ports and RS-232C is a standard definition of signaling levels for these interfaces, it makes far more sense to interface at this level rather than at the internal bus level. The key difference is that they still provide software control of modem functions. Again I would recommend using vendor-provided software for these devices. The software could be provided by the manufacturer of the computer or the manufacturer of the modem. For example, the software provided by IBM for the asynchronous communications interface, to which a modem can be attached, will interface with the Hayes Smartmodem. Sources for software can be found in the appendix.

Establishing a Connection

Depending upon the equipment in use, the procedure for establishing a connection will vary. We will attempt to describe a few, but I will be using my own system as an example.

If you have a terminal and an acoustic coupler you must first be sure that the available switches on the coupler are in the proper position. This usually means the answer/originate to originate and the full-/half-duplex to full-duplex.

The terminal itself may also have switches that must be set. Usually they are the half-/full-duplex switch and the baud rate. You will probably have to consult the manual shipped with the terminal but the baud rate should be 300 and full-duplex set.

After the switches are in the proper position, dial the phone number for the BBS, 512-852-8194. After you hear the tone on the phone, place the telephone handset in the acoustic coupler. Be sure that the handset is oriented in the proper direction. There is usually a marking on the coupler that will indicate the direction for the handset placement.

Shortly after the handset is placed in the coupler, the coupler should send its carrier in response to the carrier tone received from the other end. When this is done, the first part of the logon message will appear on the screen. The exact text of the logon message will be given later. Note that the message will be displayed as soon as the remote carrier is sensed by the BBS. You do not have to type anything as with some other systems.

A direct-connect modem is very little different than an acoustic coupler. It usually has the same switches as well as one additional; DATA/TALK. The call to the BBS number is initiated with the switch in the TALK position. When the tone is heard, the switch is changed to the DATA position. With some of these types of modems the telephone handset may be placed back on the cradle after the switch is changed to DATA. Others require that the handset remain off the hook.

The final type of connection procedure involves the case of a computer, connected to an external modem or with a modem as an integral part, that is executing software to control the modem as well as transfer data from the system terminal to and from the modem. This is the situation at my station.

For the computer/program/modem case there may still be some switches to be set on the modem particularly if it is external to the computer. The best advice here is to consult the instruction book supplied by the modem manufacturer. On the other hand, all functions may be software controllable by the program that you may be running. Some terminal control programs allow many more features than are required to use the AMSAT BBS. For example, many will allow the transfer of files from the BBS to the receiving computer and vice-versa. This feature is not presently necessary to use the AMSAT BBS and even if it is used in a later version, it will be optional.

To establish a connection in my system, I execute the terminal control program which displays the following menu:

```
MICROMODEM TERMINAL CONTROL PROGRAM

8 BIT DATA WORD LENGTH SELECTED
1 STOP BIT REQUESTED
NO PARITY SELECTED
TRANSMISSION SPEED IS 300 BAUD
FULL-DUPLEX MODE SELECTED
CAPTURE BUFFER CLEARED
DEBUG MODE OFF
COMMAND:_
```

The above is the terminal control program menu. It shows the default parameters required for using the AMSAT BBS.

The particular modem in use here allows automatic dialing, so in response to the request for a COMMAND:, the text D8528194 is entered where the cursor, _, appears above. This autodials the number. If you were using the same system but were at a remote location, you would enter D15128528194 since you would need the "1" to direct dial long distance, and perhaps the area code "512".

After the dialing is complete, this message appears:

```
WAITING FOR CARRIER, PRESS ANY KEY TO
ABORT.
```

When the carrier from the BBS is received, this appears:

```
CONNECTION ESTABLISHED.
```

After this point these lines will appear:

```
WELCOME TO THE AMSAT SOFTWARE BBS V
1.0
PREPARING FOR LOGON, PLEASE WAIT...
```

Beginning with these last two lines, the messages and responses will be the same no matter what method was used to establish the connection.

New User or Old?

After the initial logon message and a time delay to allow the logon processor to load, the following will appear:

```
HAVE YOU EVER LOGGED ON THIS SYSTEM BEFORE (Y/N)
?_
```

It is now that the system would like some information from you if this is your first time on the system. What follows is the response from the BBS should you answer "N" to the above question.

```
THANKS FOR YOUR INTEREST IN THE AMSAT BBS
PLEASE READ THE INFORMATION BELOW BEFORE LOGG-
ING ON
WHEN ASKED FOR YOUR USER ID USE ONE OF THE
FOLLOWING:
  1. YOUR AMATEUR STATION CALLSIGN
     ANY VALID CALLSIGN MAY BE USED.
  2. YOUR AMSAT MEMBERSHIP NUMBER
     EITHER AMSRM00000 or AMSLM00000
     AMSRM FOR REGULAR MEMBERS
     AMSLM FOR LIFE MEMBERS
     REPLACE 00000 WITH YOUR MEMBER NUMBER
     FOR EXAMPLE, AMSRM05876
  3. YOUR MODE-J CLUB MEMBERSHIP NUMBER
     USE MODEJ00000, REPLACE 00000 AS ABOVE
     FOR EXAMPLE, MODEJ0064
PLEASE MAKE NOTE OF THE NUMBER FOR LATER
REFERENCE
USERID:_
```

Before filling in the questions that will follow, some comments are in order. Obviously, there is no way to tell a valid amateur callsign from an invalid one. In fact any character string that has not been used before will get you into the system. If you would rather not use one of the above choices, you may choose something else but please use a sensible choice such as social security number, drivers license number, etc.

After supplying the user id, if one were logging on for the first time, one would see and respond to the following questions:

```
USERID: N5AHD
NAME: DIERSING ROBERT J
ADDRESS: 6300 OCEAN DRIVE
CITY: CORPUS CHRISTI
STATE/COUNTRY: TX
POSTAL CODE: 78412
TELEPHONE: 5129919189
COMPUTER TYPE: CROMEMCO Z2D
TERMINAL TYPE: H19
MODEM TYPE: MICROMODEM-100
REPLY Y/N TO THE FOLLOWING
AMSAT MEMBER: Y
PROJECT OSCAR: N
MODE J CLUB: Y
```

If the user entered has not been used before and everything else is in order, the system will respond with:

```
N5AHD LOGGED ON AT HH:MM:SS: UTC, YY/MM/DD
```

If one had previously used the system, one would need only enter his user id and none of the other questions would appear. The logon timestamp would be the next message that one would receive.

There will be a delay until the next message appears. It will be:

```
ENTER YOUR CHOICE (G,S,R,A,C,D,F,M,?)_
```

This is the abbreviated command list. You can display a complete command list by entering either ? or M. The system response to the M or ? command is:

```
G = GOODBYE, TERMINATE CONNECTION
S = SCAN MESSAGES (SUMMARY)
R = RETRIEVE MESSAGE
A = ADD MESSAGE
C = CHANGE MESSAGE
D = DELETE MESSAGE
? = SEND COMMAND LIST AGAIN
F = DISPLAY FILE LIST
```

Additional instructions can be obtained from an instruction file that is accessable via the F command. The F command displays the following list of files:

```
LOGON = LOGON MESSAGE—PURPOSE OF SYSTEM
CBBS = BBS SOFTWARE AND HARDWARE CONFIGURA-
TION
ORBIT = OSCAR AND RADIO SPUTNIK SATELLITE OR-
BITAL PARAMETERS
ASEGN = AMSAT SOFTWARE EXCHANGE— GENERAL IN-
FORMATION
ASEPL = AMSAT SOfTWARE EXCHANGE— PROGRAMS
AVAILABLE
INSTR = INSTRUCTIONS ON COMMAND FUNCTIONS
BUGS = SYSTEM BUGS BOTH FIXED AND UNFIXED
SYSOP = INFORMATION ABOUT SYSTEM OPERATOR
UO9ST = STATUS OF UOSAT-OSCAR-9 SYSTEMS
UO9TM = TELEMETRY FROM UOSAT-OSCAR-9
CHOOSE FROM THE LEFT COLUMN AS DESIRED_
```

If you now choose the file INSTR you will receive a detailed listing on the operation of the commands.

Once you can log on to the system and are familiar with the commands, you will probably want to scan some of the messages on the system. Messages can be scanned by addressee, sender, subject, last logon, or beginning with a certain number. When scanning by subject, the search argument you are asked to specify can appear anywhere in the message subject field, not necessarily left justified. The following is an example of a scan requested to begin with a specific number.

```
ENTER YOUR CHOICE (G,S,R,A,C,D,F,M,?) S
T=TO,            F=FROM,            S=SUBJECT,
L=LAST LOGON, N=START NUMBER
ENTER TYPE (T,F,S,L,N) N
ENTER STARTING MESSAGE NUMBER 380
NUMBER: 381  DATE: 091582  TO: N5AHD  FROM: N9AGC
SUBJECT: MISC
NUMBER: 382  DATE: 091582  TO: KO51  FROM: WA5ZIB
SUBJECT: HAMCON
NUMBER: 385  DATE: 091782  TO: N5AHD  FROM: W31WI
SUBJECT: PACMAN
NUMBER: 386  DATE: 091782  TO: WA5ZIB  FROM: KO5I
SUBJECT: 382
NUMBER: 388  DATE: 091882  TO: SYSOP  FROM: W6OTE
SUBJECT: SOFTWARE
NUMBER: 389  DATE: 0918822  TO: ALL  FROM: WA2MCT
SUBJECT: ZX-81 AS A TERMINAL
NUMBER: 390  DATE: 0918822  TO: W6OTE  FROM: N5AHD
SUBJECT: NR 388
NUMBER: 391  DATE: 091982  TO: W3IWI  FROM: KA9Q
SUBJECT: ACCESSING YOUR SYSTEM
ENTER YOUR CHOICE (G,S,R,A,C,D,F,M,?)
```

A typical message scan starting with a specific number

One thing to remember when accessing messages is that the 20 latest messages can be accessed much faster than the others in the file. This has been done under the assumption that the latest material will be accessed more often. In the previous example, even though the requested starting number was 380, the display began at 381 since 380 had already been deleted.

Once you can log on, are familiar with the commands, and can be display messages, there are only two features left to be learned: addition and deletion of messages.

A message may be entered into the system anytime the following is on the screen:

```
ENTER YOUR CHOICE (G,S,R,A,C,D,F,M,?)_
```

If you would like to enter a new message respond with A, you will then be asked some additional questions. A sample message add is shown below:

```
ENTER YOUR CHOICE (G,S,R,A,C,D,F,M,?) A
```

The system then responds with:

```
YOUR MESSAGE NUMBER WILL BE nnn (nnn next message
number supplied by the system)
ADDRESSEE: ORBIT MAGAZINE
SENDER: N5AHD
SUBJECT: DEMO MESSAGE ADDITION
PASSWORD:
1. THIS WILL DEMONSTRATE THE ADDITION OF A
MESSAGE TO THE BBS FOR
2. AN ARTICLE BEING PREPARED SEPTEMBER 28, 1982. A
NULL LINE
3. (C/R ONLY) WILL TERMINATE THE MESSAGE ADDITION
PROCESS.
4.
ENTER YOUR CHOICE (G,S,R,A,C,D,F,M,?)_
```

Some comments about the proceeding example are in order. You may specify a password but it will not keep others from being able to read the message. It will only keep others from deleting the message. The system operator (N5AHD) can delete messages whether or not they have a password. Notice the line number prompts. On line 4 no text was entered; only the C/R character. This terminated the addition process. Even though long messages are possible, I would advise a limit of about 24 lines since this will fit on an 80 x 24 screen. Not everyone using the system will have a printer for printing long messages.

Finally, the topic of deleting messages is addressed. Please try to delete *all* messages that are no longer needed. Even though the present rate of use of the system is fairly low, file reorganizations must be done about every two weeks. This is necessary because the D command results in a logical deletion but not a physical deletion until the reorganization is done. A deletion would be done as follows:

```
ENTER YOUR CHOICE (G,S,R,A,C,D,F,M,?) D
```

The system would respond with:

```
ENTER MESSAGE NUMBER TO DELETE_
```

You supply the number. After deletion you would see:

```
MESSAGE NO. nnn DELETED
ENTER YOUR CHOICE (G,S,R,A,C,D,F,M,?)_
```

If the system responds with the ENTER YOUR CHOICE message before a MESSAGE NO. DELETED message it means that the message number you specified was not in the file or had already been deleted.

To log off the system, enter the choice G. The system will respond with the following:

```
N5AHD LOGGED OFF AT HH:MM:SS UTC, DURATION
HH:MM
THANKS FOR CALLING!
```

Bulletin Board System Software

Although most potential users are probably not interested in the detailed internal operation of the bulletin board system, a short summary of system organization follows.

The system consists of six program segments which together form a complete operating system. The components of the system and their purpose are:

1. CBBSINIT - This routine is the first to execute and performs certain initialization functions such as setting the date and time and opening the message and log files. This segment displays a menu from which all other system functions are executed.

2. CBBSCBBS - If the main on-line bulletin board execution is selected in CBBSINIT, this routine is entered and after some housekeeping waits for the telephone to ring.

3. CBBSLOG - If CBBSCBBS receives a valid caller and a connection is established, CBBSLOG is called to check for a user record in the log file. Either the user is verified as a previous user, a new log file record is built for a new user, or the user is forced off the system.

4. CBBSCBBS - Even though this program has already been mentioned, it is included here because it receives control back from CBBSLOG and handles the remainder of the session. At the end of the session, CBBSCBBS calls CBBSLOG to log the user off the system. CBBSLOG returns to CBBSCBBS who waits for the next caller.

5. CBBSLOCL - Is a version of CBBSCBBS except that it provides the system operator with local control of the system. It provides all the same functions available to the telephone user except that they are done on the system console and not via the telephone line.

6. CBBSRORG - Is a maintenance program that is used for a variety of purposes. The most common use is the reclaiming of the space used by messages which have been logically but not physically deleted. It can also list the contents of the message and log files and check the percentage of reclaimable space in the message file.

7. CBBSFFIX - Is used to repair any damage to the pointers that are used to link messages and text together in the message file. It has only been needed once but is good insurance to have available.

All of the bulletin board system software is written in Cromemco 32K Structured Basic. The system is presently operating on 5¼ inch double-sided double-density floppy disks. A conversion to hard disk will be implemented sometime before January 1, 1983. More information about the system hardware configuration can be found by accessing the bulletin board system and reading the "CBBS" file via the "F" command.

Appendix

There are many manufacturers of modems and interfaces which can be used with microcomputer systems and terminals. The author is the most familiar with products made by D.C. Hayes and thus used them as examples in this article. There is no intention to endorse or recommend their products over any others that may be available.

Radio Shack manufactures modems and provides software for use with their computers.

IBM provides a modem interface and modem control software for the Personal Computer. As far as I know, they do not provide the actual modem.

Potomic Micro Magic Incorporated is a supplier of S-100 bus compatible modems.

In addition to supplying a variety of modem products, the D.C. Hayes Co. publishes the Software Vendor Directory which lists software form many manufacturers that is known to be compatible with their products.

Improving Mode-A Station Performance

Continued. . .

their responsibility, and RF noise usually indicates lost power in their system. As a last resort you might point out that the FCC requires power companies to rectify RFI problems promptly.

For those in urban or industrial areas, the noise problem at 29 MHz may be more difficult to solve. For example, the author activated 4U1UN at United Nations Headquarters on AMSAT-OSCAR 8. The noise there in midtown Manhatttan was so bad that we could never hear our own downlink. With perserverance, however, more than 30 stations were eventually worked by W2RS, W2TO and N2KW.

Mode A operation has provided a decade's challenge and enjoyment for the author. Many QSO's such as at 4U1UN, took place under far less than ideal conditions. Some readers may not be able to take advantage of all of the suggestions in this article. Please do not be discouraged; make use of what you can and try to do your best with what you have available. Some fortunate folks, such as those in rural areas or those without antenna restrictions, may be able to do considerably better than W2RS has done. It is hoped that this article may be of some help to all.

Shown above is K8OCL at the AMSAT Annual General Meeting. Below is the best DX to attend that meeting, PY2BJO.

AMSAT Software Exchange (ASE) Update

By Robert J. Diersing,* N5AHD

As some are aware, we have had our share of problems during our first year of ASE operation. The experience pleased no one; especially those who placed orders! Usually there are some lessons to be learned from bad experiences. We have learned our share. Since all of the bad is behind us, let's bring you up to date on what is happening and what is available.

Beginning with the publication of this issue of *Orbit* the address for ordering programs or requesting information will be: AMSAT Software Exchange, Box 27, Washington, D.C. 20044. Note that this is, of course, the same address as AMSAT headquarters. Please indicate that the correspondence contained is related to ASE. Do not include requests for memberships, requests for *ASR* subscriptions, etc., in the same envelope. One of our problems during the past year has been the receipt of just about every type of AMSAT mail rather than just computer-related questions.

Inquiries

You are welcome to submit inquiries about software that is available. When you *do* submit an inquiry, please include an SASE. In one batch of mail I recently processed about one in three inquiries did not include SASE or return postage. Inquiries that do not include SASE are answered but they go to the bottom of the stack. I suspect that with the launch of Phase IIIB there will be many inquiries and orders so those who do not include an SASE might take a long time to surface. Please do not send requests for *ASR* subscriptions and other non-ASE-related business to the software exchange.

Announcement of New Programs

During the past year we have had to process requests for many programs that we do not have available. As you can imagine it is difficult to have a version of a program available for each different microcomputer that is now available. We have managed to come up with only a few new ones this year.

New programs and new conversions of old programs will be advertised as follows:

1. AMSAT Bulletin Board System which can be reached at (512) 852-8194. More on this later and elsewhere in this issue.
2. New versions will be announced in *ASR* but *ASR* will not carry complete listings of all that is available due to space limitations.
3. *Orbit* magazine will carry complete listings from time to time.

Order Processing Priority

The following order is used when processing mail received by ASE:

1. Orders which clearly specify what is wanted and include remittance, assuming of course it is available.
2. Information requests that include an SASE.
3. Information requests that do not include an SASE.
4. Information requests that require some research before a reply can be given.

Please remember that, like most other services of AMSAT, many of those doing work for ASE are volunteers. Things that can be done quickly get done first.

Conversions to New Systems

We are always looking for versions of programs to run on machines that have previously been unsupported. If you get a program running on a new machine, please DOCUMENT how to use it and send us a copy. Indicate whether or not you would be interested in distributing that version for ASE. Please make sure that the program is well debugged before you submit it to us for distribution. We will check it out pretty thoroughly anyway but it wouldn't hurt for you to let some of your friends check it out too and see how successful they are in reading the documentation that you have written. If you don't see a certain machine implementation on the list at the end of this article, we still need it.

Element Sets

All of the W3IWI orbit prediction programs that are being distributed require the NASA element sets for reference parameters. This information is available periodically through *ASR* and also is updated weekly on the AMSAT Bulletin Board System. You may also obtain them direct from NASA as described in *ASR* #48/49 but it would probably be better to obtain them from one of the AMSAT sources rather than give the government some more mail to process.

Calculator Program Orders

The AMSAT Software Exchange address listed previously handles only programs for microcomputer systems. Orders for and inquiries about programs for calculators such as HP-41C should be directed to: AMSAT Calculator Program Library, John Montague, W0RUE, Box 541, Willenie, MN 55090.

AMSAT Bulletin Board System

The AMSAT Bulletin Board System has been in operation since March, 1982. There have been over 160 users on the system since that time. Complete information about the system can be found elsewhere in this issue of *Orbit*. The bulletin board system is an excellent way to communicate your needs and also obtain help with programs and computers you might be using. Many of you who were caught in the backlog of mail know that I tried to answer you queries received via the BBS as quickly as possible. Your use of the system is most welcome.

Programs Available

The following versions of the W3IWI orbit prediction are available:

1. TRS-80 Model I level II BASIC. Some users have experienced trouble running this version on minimum machine configurations. You should probably have a 32K system or plan to do some customizing. (L, C, D)
2. TRS-80 Model III. The programs will run on either a 32K or 48K system but NOT 16K machines. At least one disk drive is required. (L, D) NEW since last listing.
3. North Star BASIC under North Star DOS for 5¼ inch, hard sectored diskettes. (L, D)
4. Microsoft BASIC version 5.21 under CP/M single density, soft-sectored, 8 inch diskettes. (L, D)
5. APPLE/II BASIC on either 13 or 16 sector diskettes or cassette tape. Please specify 13 or 16 sector DOS. (L, C, D)
6. PL/I-80 Version 1.3 under CP/M, single density, soft-sectored, 8 inch diskettes. (L, D)
7. IBM Personal Computer Advanced BASIC for 64K disk systems. (L, D) NEW since last listing.
8. Texas Instruments TI 99/4 cassettes only. (C) NEW since last listing.

The K0RZ antenna positioning software as described in *Orbit* No. 11 is also available. Note that this software will work only on the APPLE/II computer with the hardware accessories as described in the article. However, it might be a good starting point for those wanting to implement a system for a different type of computer. (L, D) NEW since last listing.

How to Order

Orders for the preceding software should be sent to the address given above. The prices are:

$15.00 for each program on diskette
$10.00 for each program on cassette
$ 5.00 for each hardcopy listing

These prices include the diskette/cassette tape so DO NOT supply one with your order. Any extra donations above the listed price as well as any profit remaining above the cost of operation of ASE will be contributed to the Phase III project.

(L) Indicates that hardcopy listings are available.

(D) Indicates that diskettes are available.

(C) Indicates that cassette tapes are available.

Thank You

Once again, thank you for your patience during the past year. You can be sure that every effort will be made to make 1983 180-degrees out of phase with 1982.

**Director of Computer Services, Corpus Christi State University*

Around the World

By Kaz J. Deskur,* K2ZRO

Without a doubt the total technical experience and know-how of AMSAT members is very extensive, and I think that this "collective wisdom" can be tapped for the purpose of developing an "ultimate" Satellite Downlink Receiver. The general specifications would require the Receiver to work directly on mode A, and serve as a tunable i-f for vhf and uhf converters. Preferably, the Receiver should be relatively inexpensive, easy to duplicate, contain no "exotic" components, operate from 12Vdc, and be highly immune to interference from the nearby uplink transmitter. The performance specifications of the Satellite Downlink Receiver would differ from a typical ham-bands, multi-mode, multi-purpose, jack-of-all trades receiver, that usually possesses fancy and expensive features that are of marginal value to OSCAR users; but, at the same time, often lacks attributes essential to satellite communications. Here is the plan: In this issue of *Orbit* the initial basic performance requirements are presented. Now, the readers are requested to provide comments and submit proposals of more detailed specifications and/or a list of desirable features. These must be supported by a written justification. All incoming material will be reviewed, and highlights will be printed in *Orbit*. At the same time, the readers are encouraged to send in copies of applicable circuit diagrams, either of their own design or those published in technical literature. It is not necessary to submit proposals of an entire receiver; in fact, separate designs of individual stages (front-end, mixers, i-f, filters, noise blankers, etc.) are much preferable because a "modular" approach to a system design permits greater flexibility and allows selecting best solutions from a variety of concepts. In the "spirit" of this column—"Around The World"—we would like to mobilize the members in all countries to conduct a literature search (old, new, amateur or professional) and through their collective effort develop the "ultimate" but practical Satellite Downlink Receiver. The participants don't need to be scientists, engineers, or experts; those that can only recognize the suitable solutions, printed in technical publications, and send them in, will be contributing as much as those that develop the circuits themselves.

While submitting any material, please make sure that its source is included that we can give credit to the originator. In this column, we will keep readers informed on the progress of the project, print updated specifications, and present more interesting concepts. Finally, after sufficient data have been collected, a panel of "experts" will be called upon to evaluate all proposals and to select most promising designs and concepts. Their verdict will be published for all to know. All entries should be sent to K2ZRO (editor of this column) who will maintain engineering files of this project.

To get things started and to stimulate thinking (or, perhaps, controversy), here is a list of general design requirements. These are, of course, subject to changes, additions, and more precise definition of design objectives.

Tuning Range: 300KHz (29.250-29.550 MHz) is adequate for mode A, B, and J. For mode L the range must be much wider unless the converter range can be split into two or three "bands."

Sensitivity: Because the receiver can work with an external high-quality, high-sensitivity 10m preamplifier or vhf and uhf converter, the sensitivity of the receiver itself needs not be high. NF of 10 to 15 dB, or S+N/N of .5 to 1uV for 2.5 KHz BW is probably adequate.

Dynamic Range: The signals within the bandpass of the downlink of the satellite vary in strength by no more than 40 dB; consequently, the dynamic range within the band covered by the receiver needs not be much greater.

Strong Signals Rejection: Strong signals rejection within the tuning range of the receiver is no major problem...there are no strong signals there. (With the decline of the sunspots activity the "intruders" will vanish; then, when the sunspots return, the amateurs should be sufficiently educated to stay away from satellite-assigned frequencies.) The rejection of strong signals originating outside the bandpass of the receiver will be a serious problem; and, in this respect the receiver must be superior. While receiving very weak signals, cross-modulation, intermodulation, front-end overloading, images, and spurious responses are highly undesirable. This implies a need of very good front-end filters (perhaps tunable), good linearity of amplifiers, harmonics-free oscillators, and good shielding.

"Birdies": The mixing scheme must be so selected that there will be no "birdies" flying inside the tuning range of the receiver.

Automatic Gain Control: Because the received signals don't vary much in strength, agc is probably not necessary, and may even be undesirable. It appears that an audio compressor, or clipper, would be more advantageous than agc.

Selectivity: For the sake of economy a single i-f filter with 2.5 to 3.0 KHz BW should be adequate. Since, as mentioned before, the signal strength range of received signals is rather low and agc is not required, the "skirts" of i-f filter don't need to be very steep if a good audio filter (preferably with adjustable bandwidth and frequency) is chosen as a main factor determining the ultimate selectivity.

BFO: Variable BFO may be an advantage because it would eliminate the need for either two i-f filters (USB and LSB) or two BFO crystals. On cw, variable BFO is a great asset (if one knows how to take advantage of it).

VFO Stability: Good short-term stability of BFO is not required because Doppler shift would "mask" any superiority of this parameter. A 10 KHz RIT is an asset however, it would simplify following the Doppler shift and scanning the band near ones own downlink signal.

Frequency Calibration: 2 KHz is adequate; digital frequency display is not necessary.

Noise Blanker: A superior noise blanker is a must! Without one, a high-sensitivity receiver is useless, particularly in high man-made noise areas. The sensitivity threshold of the NB can be set quite low because no strong "desirable" signals wil be present within the receivers tuning range. Adjustable threshold level control is an advantage.

RF Gain Control: Not necessary, but a 10 dB switchable attenuator may be of help in some instances.

AM And FM Detectors: Do we need them and if so, why?

So here it is, a project for everyone. Please send your comments, ideas, suggestions, and design concepts. I'm sure that through the collective effort of *Orbit* readers "around the world" we will develop a fine but simple Satellite Downlink Receiver that will popularize satellite communication, particularly in areas where high-priced high-performance receivers are beyond the reach of an average amateur.

An Accurate Noise Generator

An accurate noise generator capable of delivering 20 dB of stable (±3 dB) output, ranging from 0 to 1 GHz and maintaining constant 50 ohm output impedence is a rare commodity in anybody's shack. Such instrument is described in Dec. 1981 *cq-DL* by Edward Waxweiler, PhD, DJ7VD. Judging from the description, the device can be easily home-brewed, assuming one knows how to solder components with very short leads.

**Box 11, Endicott, NY 13760*

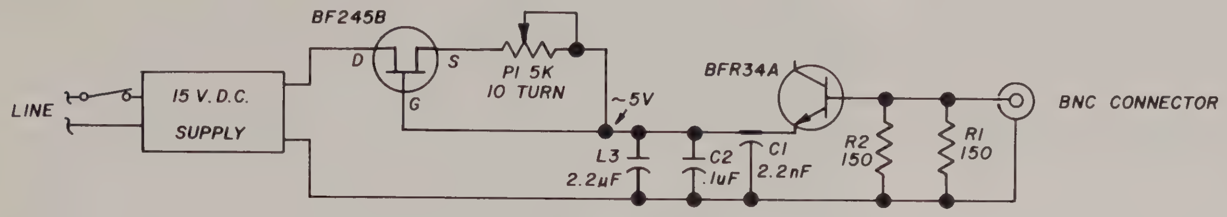


FIG. 1

Principle of Operation

The avalanche breakdown of Zener diodes is an excellent source of stable noise that theoretically extends through the entire frequency spectrum. Unfortunately, the junction capacity of conventional zeners is very high; this limits their usefulness at higher frequencies. The described circuit, Fig. 1, overcomes this problem by employing the emmiter-base junction of an uhf (5 GHz) transistor, BFR34A, that acts as a zener diode with very low junction capacity (the collector is not used).

The diode is supplied from a constant current supply (BF245B and P1). Voltage drop across the diode is approximately 5V. At this zener potential the thermal coefficient is nearly zero which makes the output of the noise generator practically immune to the ambient temperature variations. Changing the diode current will vary the output power, but it also will affect the output impedance of the generator. The change of the output impedance is not desirable because it results in a mismatch between the noise source and the input impedance of the measured device. For this reason, the generator is designed to deliver constant power, and its output level is controlled through an external attenuator.

According to DJ7VD, at .8 mA of diode current, the output impedance will be purely resistive 50 ohms. In these conditions the generator will deliver 20 dB of noise power with maximum error of ±2 dB. The output will be flat (±0.3 dB) from 0 to at least 500 MHz, and probably even as far as 1 GHz.

If high accuracy of absolute measurements is desired, the generator must be calibrated against a standard. Without calibration, this noise source is still very useful for the purposes of optimizing of circuits and comparing sensitivities of different receivers and preamplifiers.

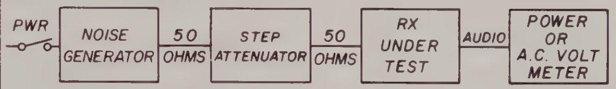


FIG. 2

Noise Figure (NF) Measurement Fig. 2

- turn off the power to the noise generator.
- turn rf gain of the receiver for maximum sensitivity
- turn agc off
- adjust audio gain to obtain 0 dB reference level of the power/volt meter.
- turn on power of the noise generator.
- adjust the attenuator to obtain 3 dB of power, or 1.41 voltage, increase of noise of the audio output of the receiver.
- calculate power: output of the generator minus insertion loss of the attenuator (for 3 dB power increase) = NF (Eg. generator output = 20 dB; attenuator loss = 11 dB; NF = 20-11 = 9 dB)

Construction

The business end of the generator is constructed on a BNC panel connector. R1 and R2 are subminature resistors soldered between the center pin and the nearest ground of the connector. The length of leads must be no longer than 1mm. An L-shaped metal-foil "lug" is connected to the ground of the connector. The leadless feed-through capacitor C1 is soldered to the lug; now, the base lead of the transistor is soldered to the center pin of the connector, and the emitter lead is passed through capacitor and soldered. Again, the transistor leads must be no longer than 1mm; the collector lead is clipped off. Beyond C1 the wiring is not critical.

The following letter from JR1SWB to I8CVS appeared in the December issue of *Radio Rivista* (Italy)

Dear Dom I8CVS..........QRM from FMer's in 145.8 to 146 MHz region is also vast problem in this country. Although there is no repeaters in Japan, with population of 120.000 radio amateurs, almost entire band for satellite on 2 meters is filled with simplex FM. The biggest trouble is most of them have no idea of satellite band and they do not know at all what they are doing for satellite fans. The idea of mode-J is, according to my way of understanding, based on such situation in this country. I really do not see what would happen after successful launch of coming Phase III; dispute? quarrel? or fight? Again, it is the reason why we at JAMSAT have been developing mode-M transponder which does not utilize 2m band.

Apparently, the 2-meter band in Japan is practically useless for the conventional amateur activities because it is used, as sounds, and behaves like the CB band in the USA. (Japan doesn't have CB service and the license to use 2-meter fm is very easy to obtain.) The above fact makes it quite clear why JAMSAT chose J mode for OSCAR 8 and is strongly encouraging flying 1.26 GHz transponder on future Amateur satellites. Ah so!

Comets

Donation to AMSAT

Logic Analyser donated by Gould Biomation shown here in place at the AMSAT Lab in Maryland.

Product Highlight File

L-Band Transmitting Equipment By SSB Electronics

By Gordon Hardman,* ZS1FE/KE3D

There are at least five firms around the world which manufacture equipment capable of generating ssb signals in the L-band amateur space segment (1260-1270 MHz). This review describes two modules which, when used in conjunction with a 2-meter exciter of 5-200mW output, can deliver 500 mW at L-band, for a moderate expenditure.

The units are the type UFA-2 crystal-controlled oscillator chain and the type USM-2 universal transmit mixer, both by SSB Electronics of Germany. They are supplied as complete kits, including all parts, a double sided fibreglass PCB, an enclosure, and documentation (in German!).

They are obtainable in Germany direct from the manufacturer.

Assembly

Documentation supplied with the kits consists of a few pages giving specifications, assembly instructions, suggestions for alignment, a schematic, as well as top and bottom parts layout diagrams and a couple of useful photographs. At the time of construction some "real live" Germans were available to help decipher the instructions. Even so, some care is recommended, as well as at least a nodding acquaintance with microwave construction practice. Frequent references to the photographs and the schematic diagram were neccessary, as the assembly instructions are somewhat sketchy. The two PCB's had a few holes missing, requiring a minor amount of rework before construction could begin. With the above caveats, assembly was completed in a reasonable time using only pliers, sidecutters and a soldering iron.

No major snags were encountered. Some care is recommended when handling the ceramic chip capacitors (some spares were found in the parts kits, presumably in case something does go wrong). The clearance between the conductive plating on some of the chips and the ground side of the PCB is quite small, and it is recommended that this be increased by removing some of the PCB copper with a sharp knife prior to inserting the capacitors (they are mounted through slots in the PCB). Unless you are familiar with the markings on European type diodes, check them with an ohm meter to determine polarity prior to insertion.

In summary, these kits are clearly intended for the more serious type of home constructor, who can understand a schematic and use common sense; they do not lead you by the hand the way some of the more well-known kits do.

Type UFA-2:-Universal L.O.

This is billed as an improved version of the company's older UFA module. It is specified as producing 10 mW of output over the 1.0-1.3 GHz frequency range. Unwanted frequency suppression is claimed at better than 50 dB below wanted, independent of the set output level. 12 Volts DC power is required.

A U310 JFET is used as a grounded gate crystal oscillator in the 96-108 MHz region and this is followed by a tripler-doubler-doubler power multiplier chain. The output passes through a 3-pole bandpass filter and the two outputs go to BNC connectors: in normal use, one goes to a transmit mixer, the other to a receiving convertor. The DC to the oscillator and the first multiplier is regulated, and a reverse polarity diode is included in series with the +12V lead. All tuned circuits, except that at 96-108 MHz are stripline types, printed directly on the PCB.

It is claimed that alignment is possible using only a multimeter, an RF wattmeter and a coaxial frequency meter. This may indeed be possible, but the unit reviewed here was aligned with the aid of a spectrum analyser, and it is doubted that the given technique would have been effective. This is because, upon first applying power, it was confidently expected that some minute output would be detectable after performing the initial bias set-up, etc., as prescribed in the documentation. In fact, no output whatsoever was detectable! It was soon determined that the oscillator was not functioning. Suspecting the tuned circuit at 96 MHz, the metal cover of the inductor was removed for inspection. The oscillator started up! Seeing no good reason to replace the shield, it was left off, with no noticeable side-effects. Still no output, down to the −60 dBm level. At this point, a "probe" was made by inserting a few cm of insulated wire in the center pin of a BNC barrel connected to the spectrum analyzer input. With the body of the barrel resting on the case of the module (ground) the probe could be brought near to the cold end of each tuned circuit in turn. Signal was indeed detected at this point. Then, starting at the oscillator each stage was tuned in turn, through to the output. When the spectrum analyzer was reattached to the output (through a 20 dB power attenuator!) the desired L-band energy was abundantly present. The stages were now re-peaked for maximun output with minumum unwanted signal level.

The unit performs very well, producing 15 mW, as opposed to the 10 mW in the specification. The only subharmonic that was above the −50 dBr specification was at half the output frequency. It proved impossible to reduce this to lower than 35 dB below full output. In view of the wide frequency separation and the fact that this is feeding another module, and not an antenna, this was adjudged acceptable. Open or short circuiting the output did not cause any problems.

Type USM-2: Universal Transmit Mixer

Again this is a second generation unit, being an updated version of the company's older type USM module. It is an up-converting transmit mixer for use in the 1.0-1.3 GHz amateur band. It requires about 6 mW of LO drive and 5-200 mW of drive from the exciter. Output power is claimed to be 500 mW and all unwanted signals are specified at 50 dB down. While the unit is designed for a 144 MHz. IF, other exciter frequencies can apparently be used, e.g., 28 MHz or 62, 25 MHz (ATV Chan. 4). Best suppression of LO and spurious signals is, however, obtained with the 144 MHz. i-f.

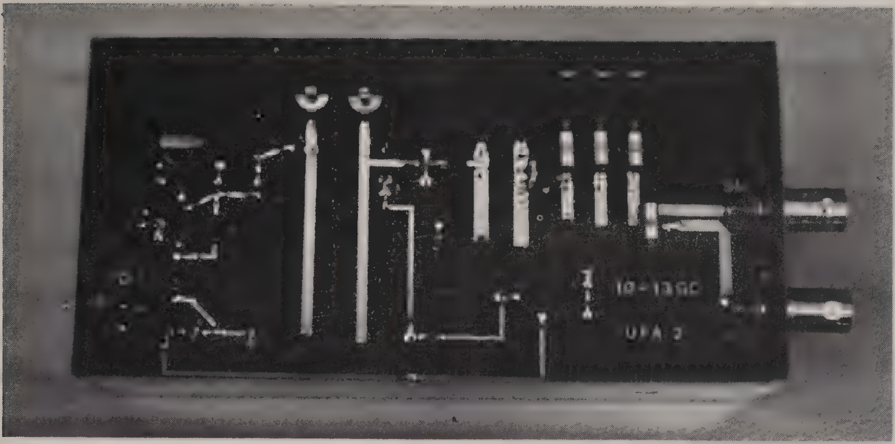
The first stage uses two BFR90A transistors in a balanced mixer. This is followed by four power amplifier stages which bring the output up to the 500 mW level. The DC input to the mixer and the bias for all stages is regulated. All tuned circuits, except the input at 144 MHz are printed directly on the PCB. Input and output connections are through BNC connectors. The output transistor is a type BFQ 34. There is no reverse polarity protection on this unit presumably to limit the voltage drop in the DC supply to the output transistor to a minimum.

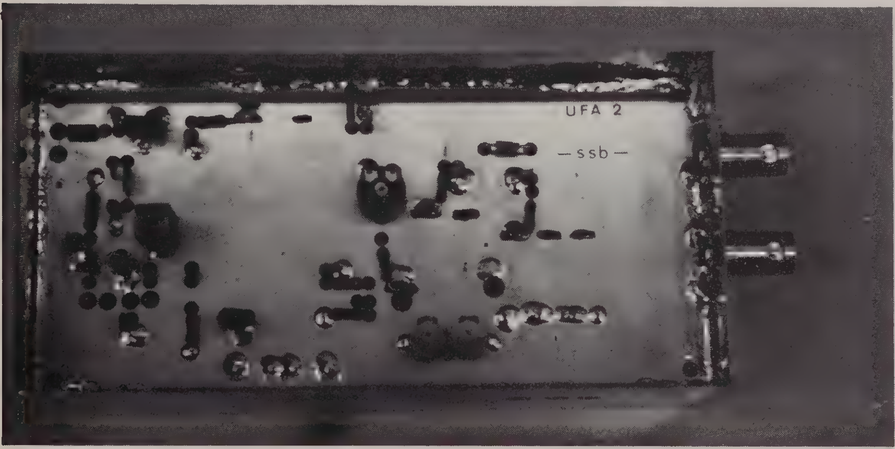
Again the claim is made that alignment is possible using only a multimeter, an rf power meter and a coaxial frequency meter. Once again, while this may be possible, it was found more convenient to use a spectrum analyser. The first thing to do is to set the bias levels to their specified values: if they are difficult to set and "twitchy" then check the bias diodes—chances are you have them in back-to-front! The probe described above was used and the stages were aligned in turn starting with the mixer. This allowed the wanted output to be seen and then the German instructions for alignment were followed.

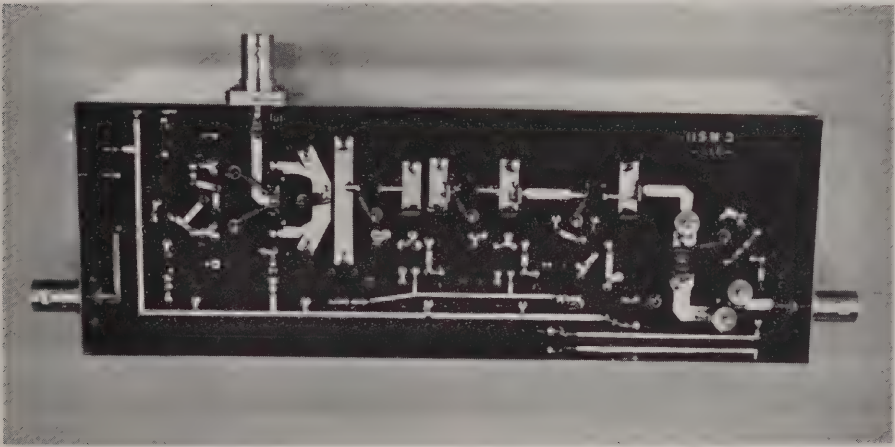
This unit also performs very well. The output power was a shade over 500 mW and unwanted frequencies can be made to be well under 50 dB below wanted. The large number of things to be adjusted on this module at first present quite a daunting aspect, but in fact things are not as bad as they seem. The

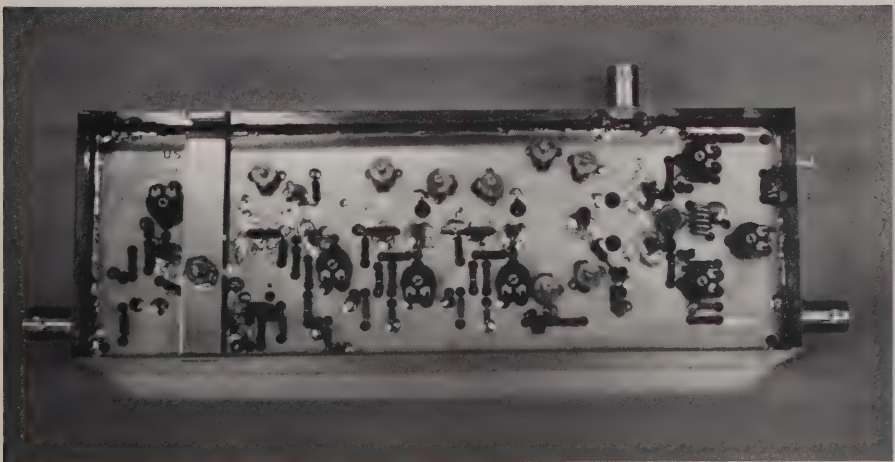
---

*Provence Kruispad, Brackenfell 7560, South Africa









variable potentiometers are first set using a voltmeter and then can be forgotten. The remaining tuned circuits are largely independent of one another in their adjustments, but it is recommended that the chain be gone through a couple of times to ensure everything is on peak. Thereafter nothing seems to upset the unit— opening or shorting the output, putting on or off the covers, or even dropping it on the workbench from the height of a few centimeters.

The combination was not tested on the air, since there was no other amateur in range who could give a signal report on 1268-1270 MHz. However, signal generator tests show that it is good and linear up to the full 500 mW level, so no on-the-air problems are anticipated.

Discussion

These units represent a departure from all other commercially available L-band amateur equipment seen by this author to date. The circuitry is straight forward and is spaciously laid out, making assembly and maintenance a pleasure. Of course, this results in a package which is somewhat bulkier than the very beautiful fully assembled units available elsewhere. For this type of application, however, it is thought that size is no problem, and for those who enjoy maintaining their own gear, may even be an advantage. The savings obtained by being able to buy only the portion you need (no RX convertor needed for Phase III) and building it yourself are unquestionable.

The instructions are adequate for an experienced builder, but if they were more comprehensive, would undoubtedly make these modules attractive to a wider audience. It is probably possible to align these units using several different methods and configurations of test gear, but the one outlined here using a spectrum analyzer will be the most revealing and the most useful in the event of problems being encountered.

The quality of the components is reasonable. The one criticism in this regard is the use of 180 degree foil trimcaps in some of the UHF and L-Band tuned circuits. These were found to be somewhat "hair triggery" and it was felt that it sure would have been nice to have piston trimmers throughout, instead of only in the output stage of the LO. Of course, herein lies one of the beauties of a kit: the individual builder has the option of fitting "de-luxe" components at the time of assembly, instead of retrofitting into an assembled unit. There is no requirement for the builder to use the enclosures supplied, and since they would probably be integrated with a power amp to boost output to the 10-100 W level and power supplies, some interesting arrangements are possible.

The author has no qualms in recommending these kits to the experienced constructor who wants moderate cost building blocks to form the basis of an L-Band station for Phase IIIB, or other purposes. Access to some L-Band test gear is essential.

Price and Availability

The units were obtained directly from the manufacturer, during a recent trip to Germany. Price class is 330 DMarks for the two, and delivery, including the special Phase III crystal, was almost unbelievably fast, just under 24 hours by mail across Germany! It is not known whether these kits are available through distributors, but the address of the manufacturer is: SSB Electronics, Karl-Arnold-Str. 23, 5860 Iserlohn, West Germany, Tel. (02371) 5 04 44, Tlx. 827803 ssb d, Mon.-Fri. 14:30-18:00, Sat. 09:00-18:00.

A wide range of other products is offered by SSB Electronics, including a SW follow-on L-band power amplifier for the USM 2 and a matching receive mixer. Although not widely known outside Germany, the firm has apparently been supplying the DL market for some time now.

Parameter	**Specified**	**Measured**
UFA-2:		
Power output	greater than 10 mW	15 mW
Unwanted outputs	greater than 50 dB down	50 dB down
Power consumption	25 mA at 12 V	less than 25 mA
Enclosure size	148 x 74 x 50 mm	
USM-2:		
Power output	greater than 500 mW	greater than 500 mW
Drive power	5-200 mW	1-200 mW
Unwanted suppression	– 50 dBr	– 50 dBr
Oscillator power	approx. 0.6 mW	10 mW used
Supply voltage	12-13.8 dc	
Enclosure size	210 x 74 x 50 mm	

Satellite Oddities

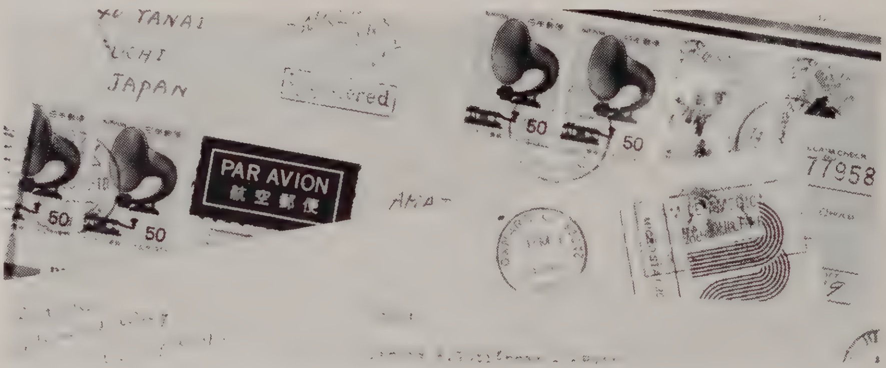
By Roy Hill, W4PID

It was on the first experimental QRP night on OSCAR 7—'way back on June 16, 1976. I was sitting there running my eight or so watts on 432 MHz and enjoying being able to hear my signal come back from space. With such low power running to a dipole mounted above a ground screen in the attic, I didn't have that privilege very often. Suddenly my signal began to increase in strength, and after a few seconds, it was the dominant signal in my receiver. It continued to become stronger for several more seconds, and all the other signals faded down and became virtually inaudible. I called CQ several times without being able to hear anyone else; and then another signal as strong as mine moved down to my frequency and I was called by W4WQZ, who just happens to be my next-door neighbor. It was as though the satellite had turned a very sharp beam on Northeast Tennessee and cut out the rest of the world. After a couple of minutes, my signal began to fade, the other signals came back in, and things returned to normal. W4WQZ and I agreed exactly on the story of this odd event.

Have you had an unusual experience while operating the satellites? If you have, and would like to share it with the rest of us, write up the details and send them to me—Roy O. Hill, Jr., W4PID, 4051 Skyland Drive, Kingsport, TN 37664 USA. If enough of you respond, maybe this can become a regular column. If not, maybe it can be an irregular column. I can't promise that I will publish everything I receive, or that I will acknowledge receipt of all "oddities"; but I will do what I can. Maybe, if we get enough information about unusual occurrences, we can learn some new things about the satellites.

Incidentally, Jerry (W4WQZ) and I claim the record for inefficient use of radio waves. We sat in our respective houses one night and worked each other on OSCAR 6 when the satellite was crossing the western end of Lake Superior. Distance traveled by radio waves (both ways): about 2000 miles. Distance between operating positions: about 75 or 80 feet. Can anyone beat that? If you can, let's hear from you!

Letters



An open letter sent to the AMSAT Board of Directors

I am writing to express my concern about the seeming lack of control of AMSAT expenditures and the method of selection of future projects to be sponsored and developed by AMSAT.

I recently read a copy of a letter from Tom Clark to the members of the Board, wherein he stated that *he* was pushing for a Packet Satellite (PACSAT) and in fact had already spent $1,000.00 of AMSAT funds for travel expenses to get the project started. I wonder just who conducted a survey of all the AMSAT members to find out, if in fact, this type of project was even desired by the *Majority* of the members, and what committee authorized this expenditure? This would seem to be ill advised if AMSAT is really in the financial bind it claims.

Therefore, I call upon you, the Board of Directors of AMSAT to form a *Future Projects Committee*, to survey the entire AMSAT membership to determine the direction future projects should take and to respond only to the wishes of the *Majority*! Further, a finance committee under a competent comptroller should review and approve all future expenditures to allow a tighter control on the available funds.

I hope other concerned AMSAT members will join me in expressing their views on this subject and that the AMSAT Board of Directors will take the appropriate action in response.—*WA6VGS*

Opinion

It is the policy of *Orbit* to publish those materials received when it seems in accord with the general interest of the members. The accompanying letter from WA6VGS was received by *Orbit* in early December shortly after the Board of Directors meeting. Mr. Somers personally telephoned the Editor to request that it be included in these pages. The letter has since been published without comment in the Mode J Club newsletter.

We have honored Mr. Somers' request as we would any other legitimate criticism of AMSAT, *Orbit* or editorial policy.

Orbit had planned to publicize the PACSAT project in a later edition with a series of articles by PACSAT project leaders including KD2S, W3IWI *et al.* In view of Mr. Somers' stern criticism, however, we thought it appropriate to preview the project through an interview with one of the project's main proponents, AMSAT President Dr. Tom Clark, W3IWI. (See page 33.)

Dear Editor:

The life blood of any organization is it's membership. The membership of an organization elects officers to lead and make decisions in the interests of the organization and consequently the voting membership. This is what our current election just accomplished. However, it disturbs me not knowing where candidates stand with regards to issues that confront AMSAT. I would like to know more about how the candidate thinks; his views as to what direction AMSAT should take if he (or she) is elected. The biographical data that accompany the ballot tells us what the candidate has done in the past and what he is currently doing—not what he can do or attempt to do for AMSAT and it's members. I feel a brief platform statement should be submitted and published along with the biographical information on the ballot.

By creating a "smart" voting membership, the elected Board of Directors will, by and large, be attuned to desires of the membership.—*W3HV*

W6SPACE PHILOSOPHER

By John Browning,* W6SP

The well-used quotation, "There is no free lunch," is sometimes modernized for the space age by adding a letter to the last word. Attempting to decide if there really is such a thing as a "free launch" can lead to some interesting semantic debates. The outcome is dependent upon the precise definition chosen for the word "free." Everyone can agree that purchasing a launch on a Shuttle or an Ariane is not cheap. It is also true that there have been no large cash outlays required to persuade various government agencies to orbit the OSCAR series satellites. Nevertheless, substantial personal commitments on the part of the leaders of the amateur space program have been necessary to secure the valuable launch agency support we have enjoyed over the past two decades.

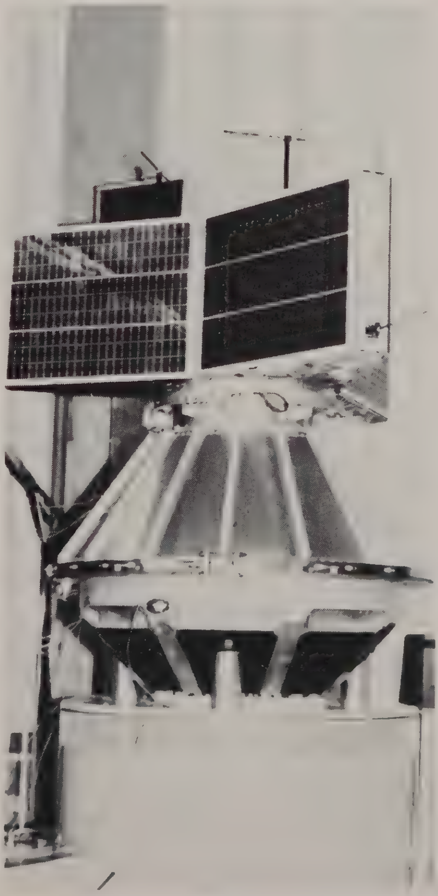
Like any passenger who wants to fly space-available, our satellites have to be at the right place at the right time to get aboard. The first challenge is to find an excess-capacity rocket going where we want to go, long enough in advance to permit adequate preparation. The desirable rides appear as infrequently as every few years. Appropriately, our getting ready also takes a few years. At the time we select a flight, we have to judge the acceptability of the risk to our own precious asset and commit to that specific opportunity, realizing there are few attractive alternatives and understanding there are *no* risk-free alternatives.

Space launchers have only a few "seats," so a single passenger has a large effect on the center of gravity of the vehicle. We have to show up at the time specified, ready to go, or an important ticketed passenger will suffer an expensive delay. We also must have the correct luggage weight and convince the crew that everything is properly secured. They are downright touchy about the safety of the lighter fluid and pressurized cans we propose to carry along. The OSCAR pioneers got us off on the right foot by keeping their promises. They were on-time and caused no problems for their hosts. That essential posture has been maintained on up through Phase III and UoSAT.

As professional space activity has expanded, so has the task of keeping in touch with the key players. To obtain launch support, we rely on informal working relationships with responsible individuals within the appropriate agencies and within the participating aerospace and electronic industries. In spite of our accomplishments, we are not well-known to the public. Attainment of government and industry cooperation depends upon our ability to provide them with a clear understanding of the worthwhile objectives of amateur space projects. Therefore, it has been AMSAT policy to man booths at the larger government-industry conventions whenever practical. We find the attendee level of interest in our wares to be as high as it is at the major ham gatherings. That is not too surprising since a large percentage of professional communicators are licensed hams and most of the others profess interest in joining our ranks. Our goal is to increase our rapport with civil government, military, and commercial space professionals and especially with their counterparts in the single industry which provides the hardware for all of them.

Since we ride into space alongside paying passengers, we have experienced a launch success rate typical of other satellite programs. On only one occasion out of ten, have we needed to don our yellow life preserver. Our best insurance is in the recognition of our fellow travelers. They are all VIP's (Very Important Packages) who must get to their destinations to avoid the creation of a void in some carefully planned and counted-on endeavor. Although no mechanical or electrical device can be absolutely guaranteed not to fail, we can be quite confident that our professional hosts will do everything humanly possible to attain success. *Bon Voyage!*

W6SP makes a point at the AMSAT Annual General Meeting.


Phase III on the shake table at AMSAT-DL.

---

*6202 Lochvale Dr., Rancho Palos Verdes, CA 90274

Satellite Log

*By Geoffrey Falworth**

Satellite Log features launches into orbit since the beginning of 1980. The satellite name is that assigned by the launching agency (the international designation is in parenthesis) and the orbit (period, inclination to Earth's equator, apogee height, perigee height) is for shortly after launch; later maneuvers may modify this orbit. Transmissions are those which are publicly reported or assumed from the type of spacecraft involved.

Westar 4 (1982-14A) launched on 1982 Feb 26; initial orbit: 1436.05 min, 0°.19, 35806 km, 35772 km; transmissions: as RCA Satcom 4 (1982-04A). Western Union communications satellite over longitude 99°.24 West.

Molniya 88 (1982-15A) launched on 1982 Feb 26; initial orbit: 718.02 min, 62°.87, 39897 km, 475 km; transmissions: 800 to 1000 MHz, 3400 to 4100 MHz. Molniya 1-class communications satellite.

Cosmos 1341 (1982-16A) launched on 1982 Mar 3; initial orbit: 717.00 min, 62°.90, 39689 km, 633 km; transmissions: 2292.000 MHz. Early warning satellite.

Intelsat 5D (1982-17A) launched on 1982 Mar 5; initial orbit: 1436.14 min, 0°.35, 3584 km, 35740 km; transmissions: as Intelsat 5C (1981-119A). International telecommunications satellite for service over Indian Ocean.

Cosmos 1342 (1982-18A) launched on 1982 Mar 5; initial orbit: 89.48 min, 72°.88, 302 km, 195 km; transmissions: none reported. Recoverable reconnaissance satellite.

Operations 8701 (1982-19A) launched on 1982 Mar 6; initial orbit: 1435.11 min, 1°.97, 35807 km, 35735 km; transmissions: none reported. Early warning satellite over longitude 67°.97 West.

Gorizont 5(1982-20A) launched on 1982 Mar 15; initial orbit: 1436.02 min, 0°.67, 34810 km, 36757 km; transmissions: 3675, 3725, 3775, 3825, 3875, 3925 MHz. Television relay satellite over longitude 52°.71 East.

Cosmos 1343 (1982-21A) launched on 1982 Mar 17; initial orbit: 89.38 min, 72°.86, 289 km; 198 km; transmissions: none reported. Recoverable reconnaissance satellite.

STS 3 (1982-22A) launched on 1982 Mar 22; initial orbit: 89.21 min, 38°.01, 246 km, 237 km; transmissions: 259.400, 296.800, 2205.000, 2217.500, 2250.000, 2287.500 MHz. OV-102 Columbia in third Orbital Flight Test carrying Office of Space Science pallet 1.

Molniya 89 (1982-23A) launched on 1982 Mar 24; initial orbit: 718.58 min, 62°.88, 39774 km, 625 km; transmissions: 3650 to 3700 MHz, 3750 to 3800 MHz, 3850 to 3900 MHz. Molniya 3-class communications satellite.

Cosmos 1344 (1982-24A) launched on 1982 Mar 24; initial orbit: 104.96 min, 82°.9230, 1012 km, 971 km; transmissions: 150.000 MHz. Navigation satellite.

Meteor 39 (1982-25A) launched on 1982 Mar 25; initial orbit: 104.14 min, 82°.54, 963 km, 942 km; transmissions: 137.300 MHz. Meteor 2-class weather satellite.

Cosmos 1345 (1982-26A) launched on 1982 Mar 31; initial orbit: 95.16 min, 74°.04, 547 km, 505 km; transmissions: none reported. Data relay satellite.

Cosmos 1346 (1982-27A) launched on 1982 Mar 31; initial orbit: 97.59 min, 81°.1697, 661 km, 623 km; transmissions: none reported. Military weather and electronic surveillance satellite.

Cosmos 1347 (1982-28A) launched on 1982 Apr 2: initial orbit: 89.57 min, 70°.36, 329 km, 176 km; transmissions: none reported. Recoverable reconnaissance satellite.

Cosmos 1348 (1982-29A) launched on 1982 Apr 7; initial orbit: 717.11 min, 62°.83, 39728 km, 598 km; transmissions: 2292.000 MHz. Early warning satellite.

Cosmos 1349 (1982-30A) launched on 1982 Apr 8; initial orbit: 104.97 min, 82°.93, 1014 km, 970 km; transmissions: 150.000 MHz. Navigation satellite.

Insat 1A (1982-31A) launched on 1982 Apr 10; initial orbit: 1436.10 min, 0°.51, 35819 km, 35761 km; transmissions: 2555 to 2591, 2599 to 2635, 3712 to 3748, 3752 to 3788, 3792 to 3828, 3832 to 3868, 3872 to 3908, 3912 to 3948, 3962 to 3998, 4002 to 4038, 4033.550, 4038.100, 4082 to 4118, 4122 to 4158, 4162 to 4198 MHz. Indian communications and weather satellite in geostationary orbit over longitude 73°.97 East.

Cosmos 1350 (1982-32A) launched on 1982 Apr 15; initial orbit: 89.78 min, 67°.14, 355 km, 172 km; transmissions: none reported. Recoverable reconnaissance satellite.

Salyut 7 (1982-33A) launched on 1982 Apr 19; initial orbit: 89.16 min, 51°.59, 260 km, 212 km; transmissions: 15.009, 20.008, 121.750, 922.750 MHz. Soviet space station with multiple docking facilities.

Cosmos 1351 (1982-34A) launched on 1982 Apr 20; initial orbit: 93.47 min, 50°.69, 546 km, 348 km; transmissions: none reported. Radar calibration satellite.

Cosmos 1352 (1982-35A) launched on 1982 Apr 20; initial orbit: 90.22 min, 70°.37, 361 km, 209 km; transmissions: none reported. Recoverable reconnaissancce satellite.

Cosmos 1353 (1982-36A) launched on 1982 Apr 23; initial orbit: 89.07 min, 82°.34, 242 km, 212 km; transmissions: none reported. Recoverable Earth resources and reconnaissance satellite.

Cosmos 1354 (1982-37A) launched on 1982 Apr 28; initial orbit: 100.97 min, 74°.03, 815 km, 794 km; transmissions: none reported. Data relay satellite.

Cosmos 1355 (1982-38A) launched on 1982 Apr 29; initial orbit: 94.05 min, 65°.19, 559 km, 386 km; transmissions: none reported. Solar-powered ocean radar surveillance satellite.

Cosmos 1356 (1982-39A) launched on 1982 May 5; initial orbit: 97.78 min, 81°.18, 670 km, 631 km; transmissions: none reported. Military weather and electronic surveillance satellite.

Cosmos 1357 (1982-40A) launched on 1982 May 7; initial orbit: 114.71 min, 74°.01, 1480 km, 1403 km; transmissions: none reported. Military communications satellite.

Cosmos 1358 (1982-40B) launched on 1982 May 7; initial orbit: 114.90 min, 74°.01, 1483 km, 1418 km; transmissions: none reported. Military communications satellite.

Cosmos 1359 (1982-40C) launched on 1982 May 7; initial orbit: 115.07 min, 74°.01, 1482 km, 1434 km; transmissions: none reported. Military communications satellite.

Cosmos 1360 (1982-40D) launched on 1982 May 7; initial orbit: 115.24 min, 74°.01, 1484 km, 1448 km; transmissions: none reported. Military communications satellite.

Cosmos 1361 (1982-40E) launched on 1982 May 7; initial orbit: 115.42 min, 74°.01, 1485 km, 1463 km; transmissions: none reported. Military communications satellite.

Cosmos 1362 (1982-40F) launched on 1982 May 7; initial orbit: 115.62 min, 74°.01, 1498 km, 1468 km; transmissions: none reported. Military communications satellite.

Cosmos 1363 (1982-40G) launched on 1982 May 7; initial orbit: 115.81 min, 74°.01, 1503 km, 1480 km; transmissions: none reported. Military communications satellite.

Cosmos 1364 (1982-40H) launched on 1982 May 7; initial orbit: 16.04 min, 74°.01, 1526 km, 1478 km; transmissions: none reported. Military communications satellite.

Operations 5642 (1982-41A) launched on 1982 May 11; initial orbit: 88.89 min, 96°.41, 160 km, 176 km; transmissions: none reported. Reconnaissance satellite.

Operations 7331 (1982-41C) launched on 1982 May 11; initial orbit: 98.87 min, 95°.99, 706 km, 700 km; transmissions: none reported. Electronic surveillance satellite.

**12 Barn Croft, Penwortham, Preston, PR 10 SX, England*

Soyuz T5 (1982-42A) launched on 1982 May 13; initial orbit: 88.66 min, 51°.60, 231 km, 191 km; transmissions: 20.008 MHz, 121.750 MHz. Manned spacecraft (crew: Anataloy Berezovoy, commander and Valentin Lebedev, pilot) docked with Salyut 7 on 1982 May 14.

Cosmos 1365 (1982-43A) launched on 1982 May 15; initial orbit: 89.65 min, 65°.00, 264 km, 252 km; transmissions: none reported. Nuclear-powered ocean radar reconnaissance satellite.

Cosmos 1366 (1982-44A) launched on 1982 May 18; initial orbit: 1432.70 min, 1°.03, 35874 km, 35769 km; transmissions: none reported. UHF communications test satellite over longitude 80° East.

Cosmos 1367 (1982-45A) launched on 1982 May 20; initial orbit: 717.29 min, 62°.84, 39774 km, 586 km; transmissions: 2280 to 2304 MHz, 2292.000 MHz. Early warning satellite.

Cosmos 1368 (1982-46A) launched on 1982 May 21; initial orbit: 90.02 min, 70°.42, 343 km, 201 km; transmissions: none reported. Recoverable reconnaissance satellite.

Progress 13 (1982-47A) launched on 1982 May 23; initial orbit: 88.82 min, 51°.51, 252 km, 186 km; transmissions: none reported. Cargo and supply spacecraft docked with Salyut 7 on 1982 May 25.

Cosmos 1369 (1982-48A) launched on 1982 May 25; initial orbit: 89.39 min, 82°.30, 279 km, 216 km; transmissions: none reported. Recoverable reconnaissance and Earth resources satellite.

Cosmos 1370 (1982-49A) launched on 1982 May 28; initial orbit: 89.22 min, 64°.85, 275 km, 197 km; transmissions: none reported. Recoverable reconnaissance satellite.

Molniya 90 (1982-50A) launched on 1982 May 29; initial orbit: 717.95 min, 62°.84, 39737 km, 631 km; transmissions: 800 to 1000 MHz, 3400 to 4100 MHz. Molniya 1-class communications satellite.

Cosmos 1371 (1982-51A) launched on 1982 Jun 1; initial orbit: 100.91 min, 74°.05, 812 km, 790 km; transmissions: none reported. Data relay satellite.

Cosmos 1372 (1982-52A) launched on 1982 Jun 1; initial orbit: 89.66 min, 64°.9877, 270 km, 246 km; transmissions: none reported. Nuclear-powered ocean radar reconnaissance satellite.

Cosmos 1373 (1982-53A) launched on 1982 Jun 2; initial orbit: 89.97 min, 70°.38, 339 km, 208 km; transmissions: none reported. Recoverable reconnaissance satellite.

Cosmos 1374 (1982-54A) launched on 1982 Jun 3; initial orbit: 88.77 min, 49°.60, 230 km, 191 km; transmissions: none reported. Winged re-entry vehicle flight test.

Cosmos 1375 (1982-55A) launched on 1982 Jun 6; initial orbit: 104.99 min, 65°.84, 1013 km, 977 km; transmissions: none reported. Antisatellite test target.

Cosmos 1376 (1982-56A) launched on 1982 Jun 8; initial orbit: 89.88 min, 82°.3440, 274 km, 261 km; transmissions: none reported. Recoverable reconnaissance satellite.

Cosmos 1377 (1982-57A) launched on 1982 Jun 8; initial orbit: 89.86 min, 64°.90, 363 km, 173 km; transmissions: none reported. Recoverable reconnaissance satellite.

Westar 5 (1982-58A) launched on 1982 Jun 9; initial orbit: 1436.06 min, 0°.07, 35853 km, 35725 km; transmissions: as Westar 4 (1982-14A). Western Union communications satellite over longitude 139°.25 West.

Cosmos 1378 (1982-59A) launched on 1982 Jun 14; initial orbit: 97.73 min, 82°.51, 663 km, 634 km; transmissions: none reported. Military weather and electronic surveillance satellite.

Cosmos 1379 (1982-60A) launched on 1982 Jun 18; initial orbit: 91.37 min, 65°.09, 543 km, 141 km; transmissions: none reported. Antisatellite interceptor made close approach to Cosmos 1375 (1982-55A).

Cosmos 1380 (1982-61A) launched on 1982 Jun 18; initial orbit: 92.63 min, 82°.90, 659 km, 145 km; transmissions: 150.000 MHz. Navigation satellite in incorrect orbit due to launch vehicle malfunction.

Cosmos 1381 (1982-62A) launched on 1982 Jun 18; initial orbit: 90.33 min, 70°.39, 379 km, 203 km; transmissions: none reported. Recoverable reconnaissance satellite.

Soyuz T6 (1982-63A) launched on 1982 Jun 24; initial orbit: 89.58 min, 61°.63, 265 km, 248 km;; transmissions: 20.008 MHz, 121.750 MHz. Manned spacecraft (crew: Vladimir Dzhanibekov, commander, Alexander Ivanchenkov, flight engineer and Jean-Loup Chretien, researcher) docked with Salyut 7 on 1982 Jun 25.

Cosmos 1382 (1982-64A) launched on 1982 Jun 26; initial orbit: 717.35 min, 62°.82, 39741 km, 597 km; transmissions: 2282 to 2304 MHz, 2292.000 MHz. Early warning satellite.

STS 4 (1982-65A) launched on 1982 Jun 27; initial orbit: 90.33 min, 28°.52, 302 km, 295 km; transmissions: 259.400, 296.800, 1763.721 to 1799.757, 1803.769 to 1839.797, 2205.000, 2217.500, 2250.000, 2287.500 MHz. OV-102 Columbia in fourth Orbital Flight Test carried DOD82-1.

Cosmos 1383 (1982-66A) launched on 1982 Jun 29; initial orbit: 105.36 min, 82°.93, 1029 km, 991 km; transmissions: 150.000 MHz. Navigation satellite.

Cosmos 1384 (1982-67A) launched on 1982 Jun 30; initial orbit: 89.69 min, 67°.15, 347 km, 171 km; transmissions: none reported. Recoverable reconnaissance satellite.

Cosmos 1385 (1982-68A) launched on 1982 Jul 6; initial orbit: 88.76 min, 82°.32, 238 km, 186 km; transmissions: none reported. Recoverable reconnaissance satellite.

Cosmos 1386 (1982-69A) launched on 1982 Jul 7; initial orbit: 104.78 min, 82°.96, 1011 km, 955 km; transmissions: 150.000 MHz. Navigation satellite.

Progress 14 (1982-70A) launched on 1982 Jul 10; initial orbit: 88.72 min, 51°.62, 242 km, 186 km; transmissions: none reported. Cargo and supply spacecraft docked with Salyut 7 on 1982 Jul 12.

Cosmos 1387 (1982-71A) launched on 1982 Jul 13; initial orbit: 89.08 min, 82°.34, 243 km, 212 km; transmissions: none reported. Recoverable reconnaissance satellite.

Landsat 4 (1982-72A) launched on 1982 Jul 16; initial orbit: 98.88 min, 98°.25, 706 km, 702 km; transmissions: 2265.500 MHz, 2287.500 MHz, 8212.500 MHz. Fourth Earth resources technology spacecraft.

Cosmos 1388 (1982-73A) launched on 1982 Jul 21; initial orbit: 114.58 min, 74°.01, 1477 km, 1395 km; transmissions: none reported. Military communications satellite.

Cosmos 1389 (1982-73B) launched on 1982 Jul 21; initial orbit: 114.77 min, 74°.01, 1478 km, 1412 km; transmissions: none reported. Military communications satellite.

Cosmos 1390 (1982-73C) launched on 1982 Jul 21; initial orbit: 114.95 min, 74°.01, 1477 km, 1430 km; transmissions: none reported. Military communications satellite.

Cosmos 1391 (1982-73D) launched on 1982 Jul 21; initial orbit: 115.13 min, 74°.01, 1478 km, 1445 km; transmissions: none reported. Military communications satellite.

Cosmos 1392 (1982-73E) launched on 1982 Jul 21; initial orbit: 115.32 min, 74°.01, 1477 km, 1463 km; transmissions: none reported. Military communications satellite.

Cosmos 1393 (1982-73F) launched on 1982 Jul 21; initial orbit: 115.51 min, 74°.01, 1486 km, 1473 km; transmissions: none reported. Military communications satellite.

Cosmos 1394 (1982-73G) launched on 1982 Jul 21; initial orbit: 115.71 min, 74°.01, 1498 km, 1477 km; transmissions: none reported. Military communications satellite.

Cosmos 1395 (1982-73H) launched on 1982 Jul 21; initial orbit: 115.92 min, 74°.01, 1517 km, 1475 km; transmissions: none reported.

Molniya 91 (1982-74A) launched on 1982 Jul 21; initial orbit: 717.73 min, 62°.98, 39742 km, 615 km; transmissions: 800 to 1000 MHz, 3400 to 4100 MHz. Molniya 1-class communications satellite.

Cosmos 1396 (1982-75A) launched on 1982 Jul 27; initial orbit: 89.47 min, 72°.86, 298 km, 198 km; transmissions: none reported. Recoverable reconnaissance satellite.

(Continued on page 31)

G3IOR

Worldwide Satellite Activity

By Pat Gowen,* G3IOR

An analysis of the first six months of 'ROBOT' operation from 'RS-5' and 'RS-7' shows that 50% of the 4,500 QSO's made were with stations in the USA and Canada, 30% in Europe, 15% from combined Africa, South America and Oceania. Individually, N4AR made the most QSO's, followed by VE5XU, W1NU, N2AA, G3IOR, DL3BJ, DL1CF, DL1CR, K1HTV, W4AOZ, and OK3AU; in that order.

Outside USSR Asia was represented by JH7CKF, JA9YAP and 9M2CR, Australia by VK5RU, South America by PY2FFC, HC1BI and HP1AC, while Africa gave ZS6HS, ZS6AO and ZS6AXT. A recent log transmission from RS-5 included a few new ones such as JH2AHP (899), JE2YEA (900), CO6J (912), VK4TL (921), JR2URW (925 & 928), and JH0JIM (929). It is hoped now that articles on how to work the 'ROBOT' and the transponders filter down from the main media to National Magazines, more countries will be represented on both the auto-responders and the passbands themselves.

During period of Solar eclipse, July, both RS-6 and 8 were permitting access 4½ minutes after horizon to the North in UTC evening, but, as might be expected, as usual when such rare events occur, not a soul normally out-of-range was on and active.

ISKRA-2 fell out of the sky during the night of 8/9 July '82, undoubtedly brought down much earlier than anticipated by the enormous atmospheric expansion that occured just before and during that period. Your author peered into his 1 MHz crystal and predicted 18 July at around midnight UTC. Ah Well! The best laid plans of mice and men...etc. Any late TLM prior to re-entry would be much appreciated by G3IOR.

The critical lack of Texas, so marginal at the G3IOR QTH in Englands most easterly city has been overcome totally, thanks to perfect QSO's with WA5ZIB, W5VVR, and KO5I. W5UCY was worked twice, while G4CUO had an 'almost' QSO with K5BTH in New Mexico!

Nick, W0CA had a QSO with UA0BB audible for eight minutes on RS-6 ssb, at S9 both ways, and believes him to be very close to the North Pole to give such elongated access, when RS-6 went from 72°N/112° to 55°N/100°W.

Do you know where this system is located?

The sporadic activity from 4UIITU (UN Geneva) as been explained in a letter from Bernard, HB9AYX, who was at the microphone with Geoff, G3NAQ during the recent re-activation. Geoff is preparing for 4UIITU 144 MHz EME, but had not tried the satellites as he had been told that "Satellite operation is very difficult and hazardous..." Without delay, Bernard and Geoff put a station together, worked out the passes, and had everything working in two hours. Together, they worked each orbit until dawn, and made twenty-two QSO's. Geoff is now firmly addicted to the new mode, already has a 10YX, and is organizing a TX defunct FT101 for downlink use for the station in a crowded clubroom where space (sic) is limited. I.A.R.C. have agreed to provide facilities from a limited budget, so soon now 4UIITU will be providing lots of space QSO's.

At 4UIUN, U.N., N.Y., Ray and Heinz are going ahead with a Mode J station, not an

Rare Stations Listing:

The following new stations are active on the satellite from some of the less heard countries.

HP1AC	All satellites	Very regular users.
CN8CO	RS6 & 8 cw	Often QRV center of cw band GMT evenings.
4UIITU	RS6 & 8 cw/ssb	Intermittenly active mainly daylight hours.
TU2IT	AO8A, RS6 & 8 cw/ssb	Often QRV in UTC evenings.
HI8DAF	AO8A, RS6 & 8 cw	Excellent signal in Europe.
UG6AD	RS6 cw	Afternoon UTC passes for EU.
UI8IAN	RS6 & RS8 cw/ssb	Afternoon UTC passes for EU.
IS0MVE	RS6 & 8 ssb & AO8A	Only station from Sardinia.
SV1DO	AO8A, RS6 & 8 cw	Greece (No Rhodes or Crete activity now).
LZ2KBI	AO8A, RS6 & 8 cw	Early evening passes UTC.
Y23SJ	RS6 cw	Not very active, and QRP.
YO2IS	AO8A, RS6 & 8 cw	Many evening UTC passes.
YO3AC	RS6 & 8 cw	Many evening UTC passes.
YO9CN	RS6 & 8 cw	Many evening UTC passes.
UA9MBF	RS6 & 8 cw	New one from USSR Asia.
UA0BBN	RS6 & 8 cw	Often active from Cape Cheyuskin.
HG2RD/M	RS6 & 8 cw	Good signal UTC.
UA9FB	RS6 cw	Daytime UTC passes in Eu.
Z2IGH	RS7 slow cw	Using 'Robot' frequency.
YV5ANE	RS6 & 8	Needed by many in Eu.

---

*17 Heath Crescent, Hellesdon, Norwich, Norfolk, NR6 6ND easy task with the proliferation of antennae on the HQ building roof.

A recent check of all time 'Radio' RS birds showed them to all be in excellent condition, with no signs of the early demise of the batteries that beset the RS-1 and 2 forerunners.

The special symposium in Kaunas was marked by the appearance of a number of special prefixes on all satellites, V12, R2PCR, PCX, PCJ, PED, PEK, PEH, PEz, etc. Leo, UA3CR was very active as R2PCR, and will QSL all QSO's. Many never received QSL's from UP2BBC so Lithuania SSR is still a much needed DXCC country by satellite.

N4AR, Bill, made WAC satellite in 27 hours by working YV5ANE at 0606, OK3AU at 1436, UA0BBN at 1453, EA8CS at 1532, KA9A at 1543 and WH6AMX at 0959 the following day. From Europe, HG8CY, OE1NAB and YZ4IN were also worked in the same period.

ROBOT

A number of headaches have been given to the RS3A command station by ill-informed users of the RS-5 and RS-7 Robot 145 to 29 MHz channels.

The loading sequence for the codestore bulletin board, although indicated by the appropriate telemetry frames, can sound as if the satellite is active as a single channel transponder, and despite pleas from the official loading station, persistent users have prevented numerous important messages from being inserted. The loading attempt is very apparent, as this is conducted at 120 wpm after a request for "No QRM" from the station conducting the procedure, as monitored on the 29.330 or 340 MHz downlink. The persistence of fm on the 145.925 and .935 MHz uplink already gives more than enough trouble without any inconsiderate behavior by those who are abusing a system by their limitation of understanding.

Further, a number of would-be 'Robot' users have complained that some stations continuously conduct QSO's one after another, never giving the chance for a first-time user to make a QSO. This type of exclusive "hogging" is evidenced by the downlink dump of stations worked by the 'Robot' and the repetition of one or two callsigns many times over.

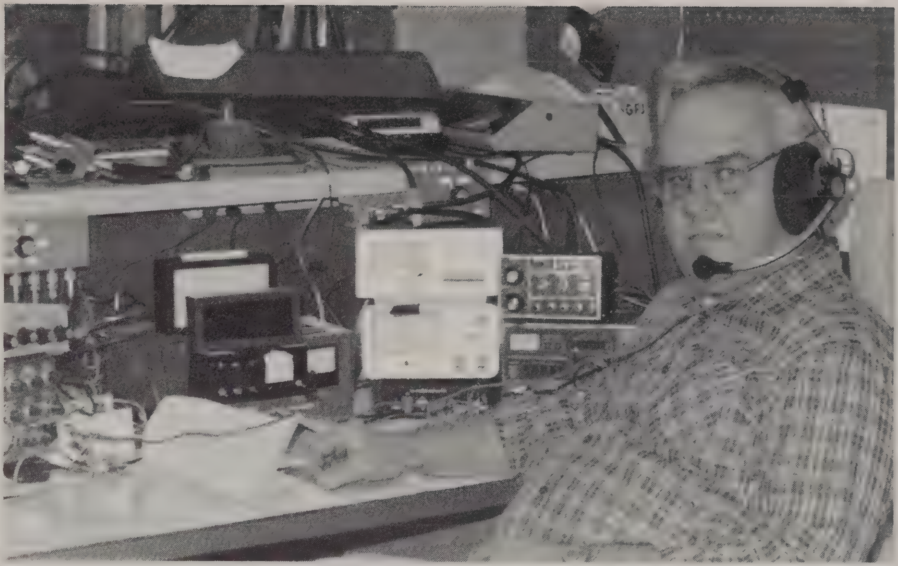
Finally, it often happens that a station will spend the entirety of each pass tuning and calling many times over using the wrong format, and even up to five minutes of a continuous long call, ending that when this fails to evoke a response, giving even longer calls next time round.

The old adage that the most effective stations spend far more time listening and learning than calling is just as true to 'Robot' use as any other form of optimum communication.

One of the most active stations in Europe is Heinz, DL1CF, who has missed few passes since the launch of AMSAT-OSCAR 7.

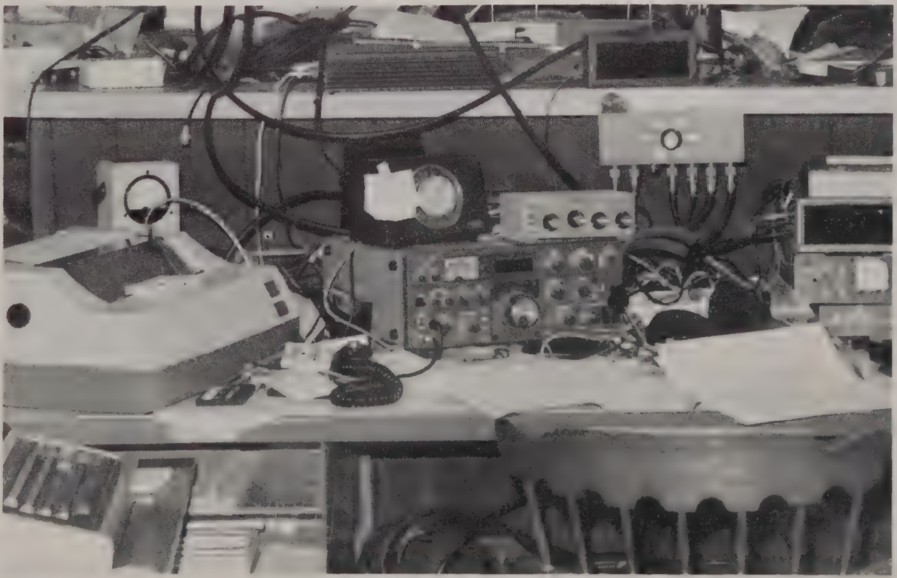
Heinz uses a TS770E with adjustable output to a non-elevating 20 element Cushcraft Collinear for the uplink, and a TS-180S fed from a 12 AVQ ground plane for the downlink on Mode A.

Some good idea of the level of activity available to Europe is evidenced by the number of stations contacted in the various countries and call areas in range of Hidesheim. The total of different callsigns

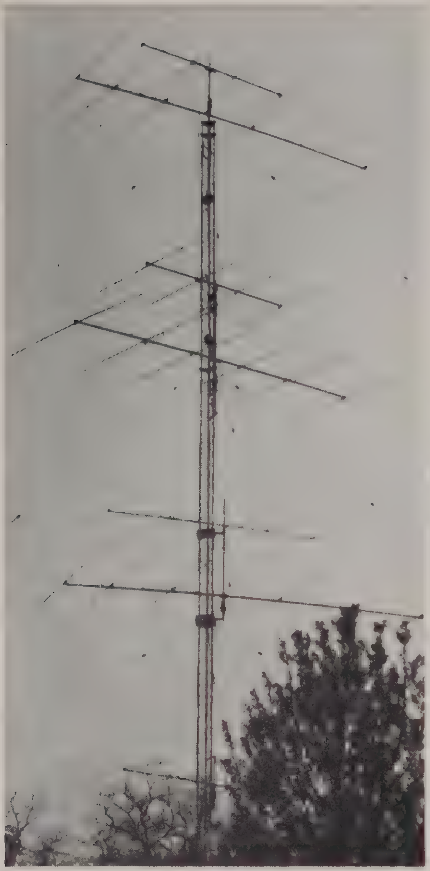


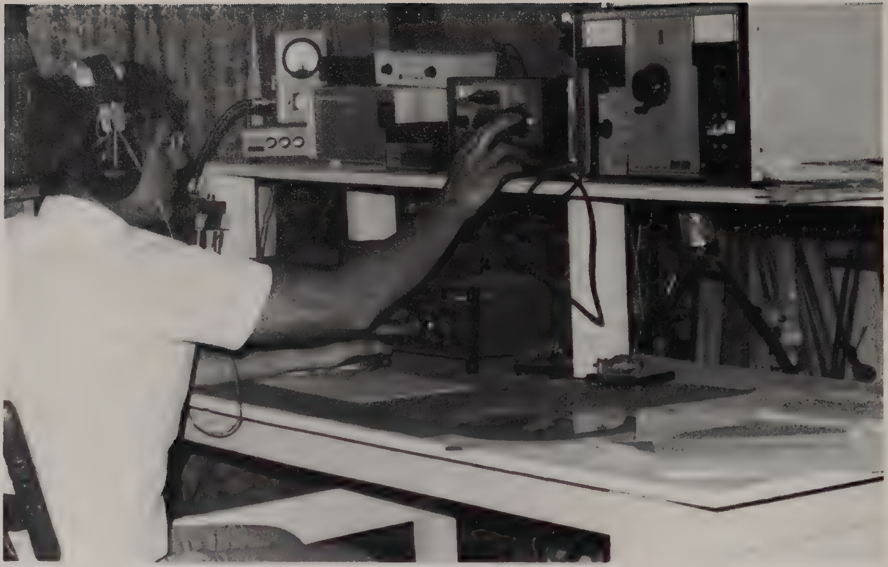
Shep, W4AUZ at the operating position of his Kentucky station.

Outside the shack at W4AUZ are KLMs, F9FTs and a TH3.



The other end of Shep's station.





The "other" Kentucky station: N4AR. Bill says the four 10-meter antennas are for low-angle passes! The top one is at 130 feet. At the right are Bill at his operating position and the vhf/uhf system mounted above some hf antennas. Can you find the three-element 40-meter Yagi?

are in brackets following the prefix, but many of these have been worked on six different satellites and many modes, often many times over.

DL/DJ etc.(130) UA Eu.(29) UA Asia(14) UB5(6)
UC2(3) UP2(3) UL7(9) UI8(2)
UD6(1) UG6(1) OX(1) CN8(1)
EA8(3) EA(5) EA6(1) F(34)
I(26) IS(1) LA(6) LZ(5)
HA(13) HB(9) YO(4) YU(21)
Y2(1) G(70) GM(8) GI(3)
GW(3) GD(1) GJ(1) SM(23)
SP(8) SV(1) OE(15) ON(13)
OZ(7) OH(13) OK(27) PA(15)
W1(9) W2(14) W3(8) W4(6)
W8(5) W9(4) W0(4) KL7(1)
VE1(3) VE2(4) VE3(2) VE4(2)
VE5(2) VE6(3) VE7(1)

Mode J

The contest for the optimum AO-8 Mode J path continues, with further extensions to the ultimate. John GM4IHJ has now enjoyed fulfilling his ambition to work Wisconsin by effecting good QSO's with Tom, W9KE, in Madison, and AL, W9HR, in Kenosha, both on cw.

Frank, K9CIS, in Decatur, Illinois also made a good QSO with John, an amazing 6200 km by using 8-J cw, and since our last report numerous QSO's have been made between Bill, N4AR, and John, GM4IHJ. The first attempts of establishing a W4 Kentucky to G Mode J QSO by tests between Shep, W4AUZ, Bill, N4AR and Dave, G4CUO resulted on a one-way only, but G6ADC both heard and was heard at the optimum time though no actual QSO resulted.

On 24 June came the second attempt and for one minute from 2318 UTC, Bill and Dave made contact with RS55 and 56 exchanges. Strange to relate that Shep, who is nearer, heard nothing, which tells us of the sporadic behavior of this mode.

Future Mode J tests on EQX between 28 and 31° West will be planned via RS6 or 8 on suitable passes, and will maintain 435.165 as the downlink frequency.

GM4IHJ was copying W1 and W2 stations at the same time as he was in QSO with EA8CS on his usual 435.127 downlink, and wonders if the boys on the eastern seaboard of USA realize that they have Africa in range?

On the Pacific side of the world, two QSO's have been made on Mode J between Rick, WH6AMX and Taka, JA8DJJ in the one minute maximum window between Honolulu and Sapporo, Mokkaido, verifying points made by John in his *Orbit* No. 10 article on Mode J DX possibilities.

All of the above shows what can really be done when dedicated enthusiasts persue the optimum and the ultimate on this exciting mode.

Did You Renew Your Membership?

Your support is needed to continue the work on Phase IIIB now being completed by your technical team. Please send your dues today!

More Satellite Log. . .

Cosmos 1397 (1982-76A) launched on 1982 Jul 29; initial orbit: 93.37 min, 50°.69, 540 km, 345 km; transmissions: none reported. Radar calibration satellite.

Cosmos 1398 (1982-77A) launched on 1982 Aug 3; initial orbit: 89.06 min, 82°.36, 236 km, 217 km; transmissions: none reported. Recoverable reconnaissance satellite.

Cosmos 1399 (1982-78A) launched on 1982 Aug 4; initial orbit: 89.65 min, 64°.90, 344 km, 171 km; transmissions: none reported. Recoverable reconnaissance satellite.

Cosmos 1400 (1982-79A) launched n 1982 Aug 5; initial orbit: 97.57 min, 81°.16, 653 km, 630 km; transmissions: none reported. Military weather and electronic surveillance satellite.

Soyuz T7 (1982-80A) launched on 1982 Aug 19; initial orbit: 90.34 min, 51°.63, 299 km, 289 km; transmissions: 20.008 and 121.750 MHz. Manned spacecraft (crew: Leonid Popov, commander, Alexander Serebrov, flight engineer and Svetlana Savitskaya, researcher) docked with Salyut 7 on 1982 Aug 20.

Cosmos 1401 (1982-81A) launched on 1982 Aug 20; initial orbit: 89.92 min, 82°.34, 274 km, 261 km; transmissions: none reported. Recoverable reconnaissance satellite.

Telesat 5 (1982-82A) launched on 1982 Aug 26; initial orbit: 1436.10 min, 0°.03, 35802 km, 35779 km; transmissions: 3702 to 3738, 3742 to 3778, 3782 to 3848, 3822 to 3858; 3862 to 3898; 3902 to 3938, 3842 to 3978, 3982 to 4018, 4022 to 4058; 4062 to 4098; 4102 to 4138; 4142 to 4178, 4198.000; 4199.000 MHz. Telesat Canada communications satellite.

Molniya 92 (1982-83A) launched on 1982 Aug 27; initial orbit: 719.29 min, 62°.86, 39934 km, 500 km; transmissions: 3650 to 3700 MHz, 3750 to 3800 MHz, 3850 to 3900 MHz. Molniya 3-class communications satellite.

Cosmos 1402 (1982-84A) launched on 1982 Aug 30; initial orbit: 89.66 min, 65°.01, 265 km, 251 km; transmissions: none reported. Nuclear-powered ocean radar reconnaissance satellite.

Cosmos 1403 (1982-85A) launched on 1982 Sep 1; initial orbit: 90.19 min, 70°.37, 358 km, 209 km; transmissions: none reported. Recoverable reconnaissance satellite.

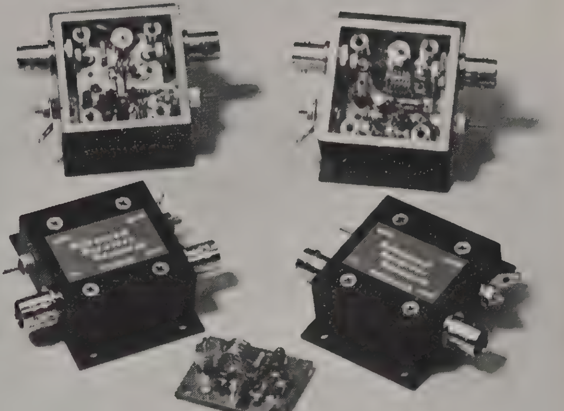
Cosmos 1404 (1982-86A) launched on 1982 Sep 1; initial orbit: 90.11 min, 72°.84, 359 km, 201 km; transmissions: none reported. Recoverable reconnaissance satellite.

Engineering Test Satellite 3 (1982-87A) launched on 1982 Sep 3; initial orbit: 107.10 min, 44°.61, 1227 km, 966 km; transmissions: 136.000 MHz at 1.0 watt, 1705.000 MHz at 1.4 watts. Japanese spacecraft carrying engineering tests.

(Continued on page 39)

High Performance **vhf/uhf preamps**

EME
Scatter
Tropo
Satellite
ATV
Repeater
FM Equipment
Radio Telescope



NEW GaAsFETs!

	Freq. Range (MHz)	N.F. (dB)	Gain (dB)	1 dB Comp. (dBm)	Device Type	Price
P28VD	28-30	‹1.1	15	0	DGFET	$29.95
P50VD	50-54	‹1.3	15	0	DGFET	$29.95
P50VDG	50-54	‹0.5	24	+ 12	GaAsFET	$79.95
P144VD	144-148	‹1.5	15	0	DGFET	$29.95
P144VDA	144-148	‹1.0	15	0	DGFET	$37.95
P144VDG	144-148	‹0.5	24	+ 12	GaAsFET	$79.95
P220VD	220-225	‹1.8	15	0	DGFET	$29.95
P220VDA	220-225	‹1.2	15	0	DGFET	$37.95
P220VDG	220-225	‹0.5	20	+ 12	GaAsFET	$79.95
P432VD	420-450	‹1.8	15	− 20	Bipolar	$32.95
P432VDA	420-450	‹1.1	17	− 20	Bipolar	$49.95
P432VDG	420-450	‹0.5	16	+ 12	GaAsFET	$79.95

Advanced Receiver Research

Preamps are available without case and connectors: subtract $10. Other preamps available in the 1 - 800 MHz range. Prices shown are postpaid for U.S. and Canada. CT residents add 7-½% sales tax. C.O.D. orders add $2. Air mail to foreign countries add 10%.

Box 1242 • Burlington CT 06013 • 203 582-9409

SWITCH 2 OR 3 OR 6 OR 9 ANTENNAS OVER ONLY ONE COAXIAL FEEDLINE
With INLINE "wireless" weatherproof coaxial relays you simply add more antennas without costly control cables.

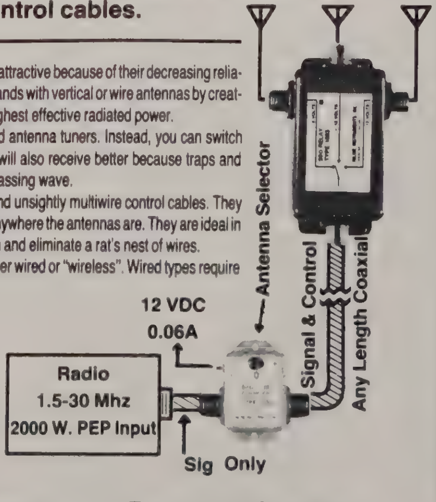
For years to come sun spot activity will make 10, 15 and 20 meters less attractive because of their decreasing reliability. You can enjoy long distance and reliable operation on the lower bands with vertical or wire antennas by creating simple 2 element arrays. Remember—efficient antennas create highest effective radiated power.

Avoid wasting RF power and radiating efficiency using band traps and antenna tuners. Instead, you can switch antennas and get up to 10db more signal into that distant point. You will also receive better because traps and antenna tuners do not provide an effective signal gathering area to a passing wave.

INLINE relays can be installed virtually anywhere without expensive and unsightly multiwire control cables. They can be placed in the attic, on the roof, on a mast, on a tree, on a tower, anywhere the antennas are. They are ideal in apartment houses to overcome restrictions. They minimize hole drilling and eliminate a rat's nest of wires.

INLINE relays are available in two position and three position types, either wired or "wireless". Wired types require 1 conductor + ground.

Two position relays
Type 101A - DC to 180 MHz - $32.95 - Wired
Type 107* - DC to 970 MHz - $48.95 - Wired
Type 105 - 1.5 to 180 MHz - $54.95 - Wireless
Type 108* - 25 to 970 MHz - $74.95 - Wireless



Three position relays
Type 1013 - DC to 180 MHz - $49.95 - Wired
Type 1053/105C - 1.5 to 180 MHz - $79.95 - Wireless

Type 1053/105C Illustrated

Other types, all frequencies available. Relay power ratings decrease with increasing frequency. See literature for detailed chart.
Distributed worldwide. Literature and application data upon request. If not in stock at your dealer order direct.
Add $2.00 for surface UPS. $3.50 for UPS Blue or Parcel Post. Overseas shipping at our cost. VISA, MASTERCHARGE accepted.
INLINE INSTRUMENTS, INC. Box 473, Hooksett, N.H. 03106 Tel. (603) 622-0240

AMSAT News

Organizational items of interest to all members of the Radio Amateur Satellite Corporation

QSL Bureau Instructions

1. The AMSAT QSL Bureau serves the users of all amateur radio satellites with a complete QSL Bureau for amateur radio satellite contacts (QSL's for QSO's other than satellite QSO's will be returned).

2. Stations wanting to use the bureau need only send between three and six #10 SASE's *with your call in the upper left hand corner*. DX stations: include enough IRC's for each envelope of file!

3. To send cards through the bureau, arrange your cards in alphabetical order by call sign. Stateside cards are free. However, there is a charge of 5^c per card for all stations outside U.S. postal districts.

4. Always keep the bureau informed of any changes in your address or call sign. If you have worked other stations with more than one call sign, you should send envelopes for both calls.

5. Mailings from the bureau will be at the end of each month. All envelopes with ANY cards will be sent at that time.

6. QSL cards that are received at the bureau when no envelopes are on file will be held and the bureau will make an attempt to notify the user that he has cards on file. If envelopes are not sent within a period of 6 months the cards will be discarded.

7. Questions about the bureau should be sent with an SASE to:

AMSAT QSL Bureau
1850 Lisle Avenue
Obetz, OH 43207

The Annual Meeting of the Board of Directors held in early December.

The AMSAT Board of Directors met over the weekend of Dec. 3, 4 and 5. The decisions rendered by AMSAT's top policy organ will affect AMSAT direction for years to come. Major highlights: new organizational structure emerging with several new officer billets identified; new dues structure approved effective 1 Apr. 83; *Orbit* magazine will continue in publication. Here are the details.

The Board of Directors gathered informally on Friday evening, 3 Dec., to discuss prospective agenda items and to elicit initial positions on issues that would be discussed later. This informal gathering, as well as the formal session on Saturday and Sunday, were held at the Goddard Space Flight Center, Greenbelt, Maryland. This is a NASA facility and Dr. Thomas A. Clark, W3IWI, AMSAT President and a NASA employee, hosted the weekend meeting.

On Saturday morning Chairman of the Board John Browning, W6SP, called the meeting to order. Present were all seven Directors including JA1ANG, G3IOR, VE2VQ, W3IWI, W3GEY, K1HTV and W6SP. Other attendees throughout the session were K8OCL, KD2S, W4PUJ, KA4JFO, W1HDX, KA9Q, KO5I, W1XT, W6XN (alternate Director), WA2LQQ, W2FPY, Martha, W2RS, W3XO, W0RPK and KA2PFD.

The first order of business was reading and adoption of the minutes of the last BoD meeting. KA9Q was named secretary to the Board. The Board then took up the question of AMSAT's connection with AFCEA, the Armed Forces Communications and Electronics Association. W3IWI explained that the involvement was limited to accepting a free booth at the Washington, D.C. convention in a manner similar to other public service organizations. W6SP pointed out that AFCEA comprises about ⅓ hams and the exposure is an excellent opportunity to develop contacts which could be very helpful in obtaining rare launch opportunities. G3IOR and W6SP agreed to co-author an article for *ASR* clarifying the AFCEA relation and underscoring AMSAT's neutral political posture in the U.S. and elsewhere.

The discussion moved next to the need to involve new personnel in the decision and management processes in AMSAT. Much thought was given to the "hows" and "whys" individuals become leaders within AMSAT and in particular how to promote participation by motivated, talented new individuals. The oft-discussed "Centers of Excellence" concept was elaborated again.

In a discussion on member services, it was decided that management of member services should be recognized and staffed separately from the functional engineering activities. Proposals for new structure within the engineering and operations directorates were presented.

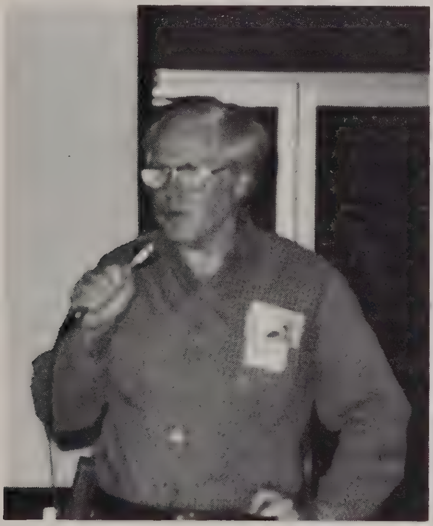
A discussion of W2RS's financial report followed. The Board allowed that the President be authorized to effect changes in the profile of the investment portfolio with the concurrance of the Chairman of the Management and Finance Committee (W2RS). It was stated that about $70,000 was expended annually on member services including salaries (Martha), office rental, utilities, *Orbit* magazine ($6,000 to $7,000 per issue) etc. The 2,000 annual members at $16/member generates $32,000; the interest on Life Member Reserves yields $8,000; the deficit is thus about $30,000 per year for member services. Tom suggested that about 25% of office time should be charged to project expenses rather than member services.

W3IWI gives a report during the A.G.M.

Many technical projects were discussed including Phase IIIB (only spin balance test remains; Mode L transponder intermod products reduced now to −35 dB); Phase IIIC (proposal submitted to USAF for DSCS 3 launch in mid-1984); PACSAT (possible university liaison; several launch opportunities; much interest in affiliated AMSAT organizations; prospects of self-funded activity); SYNCART (no viable launch opportunities in sight; IF, CPU and DC/DC xvtrs done in AMSAT Canada; rcvr and xmtr ongoing in Project OSCAR's California group; VE2VQ to give paper at conference in Ottawa in June 83); Shuttle, STS-9 (joint ARRL/AMSAT proposal submitted; AMSAT to be technical advisor with ARRL in lead role for liaison with NASA; risk/benefit ratios discussed with emphasis on "high visibility" project framework); other miscellaneous projects were discussed.

Future funding levels were then discussed followed by a discussion of various office expenses including a proposed computer for processing membership records/activities.

The Board then approved a dues increase as follows: Effective 1 April 83 the annual dues will be $24 (U.S., Canada and Mexico), $26 elsewhere. Life membership will be 25 times the annual rate. The Board allowed application by senior citizens (on fixed/limited incomes) and students for a nominal 25% discount.



W3XO explains the joint ARRL/AMSAT STS-9 (Shuttle) proposal at the A.G.M.

Amateur Satellite Report interviews Tom Clark, W3IWI concerning the Packet Radio Program.

ASR: *What is packet radio?*

W3IWI: The word packet derives from the concept of breaking long messages into small groups called packets. Packets are easier to handle through transmission systems and are more reliable. Packet radio can best be likened to high-speed RTTY, but with a few improvements. The important differences are the speed, the accuracy and the inclusion of error correcting characters and some other tricks which facilitate automatic handling of these digital messages. So packet radio shares much with prior amateur radio techniques such as cw and RTTY. Its an outgrowth of these. So although the concept might seem foreign and forbiding, it really is quite close to some things amateurs have been doing for quite a while. The fact is that now they can do it faster, more accurately and with less effort than ever before so amateurs can now concentrate on the fun of communicating and spend less time in the mechanics of it. It is important to note that many, many digital packet systems are now working in the commercial and military segments. These segments have gone "packet" for some darn good reasons. The same ones that make it very attractive to amateurs: speed, accuracy, ease of transmission and a host of more subtle reasons. An interesting overview of packet networks was given in the October 1981 *QST*, page 28, in an article by K8MMO and W4RI. This should provide you with the next level of detail answering your question.

ASR: *Tom, what is the PACSAT Project we've heard about in recent months?*

W3IWI: PACSAT is a concept for a future, low polar orbiting satellite especially designed for digital communications.

ASR: *What makes PACSAT different from other prior OSCARs?*

W3IWI: There are a few important differences. But first, let us review the similarities. PACSAT will be a communication satellite just like most of the previous OSCARs. As with the recent OSCARS it will be in a polar orbit; its altitude will be just about the same as AO-8. The main difference will be that communications will be digital. The other important difference is that it has a "store and forward" capability so that if you want to you can store a message in the satellite memory for someone who may not even be in range at the time. Later, when that person calls into the satellite, his message from you can be accessed as if you were right there. This non-real time communication is an important supplement to other real-time communications amateurs will have at their disposal including Phase IIIB.

ASR: *Does that mean that digital and analog satellites can coexist?*

W3IWI: Of course. SSB and cw probably will never be displaced by digital communications. However, there are some important reasons to look at digital techniques now as an adjunct to AMSAT's traditional satellite programs.

ASR: *Could you give us an example?*

W3IWI: Well we've already mentioned one, that is the store-and-forward concept which is remarkably effective for communications between individuals or groups with different time schedules. For example, suppose G3IOR had some important bulletins for JA1ANG. Pat could very well call Harry on the telephone but the time differences between the two would surely inconvenience one or the other. With a PACSAT bird to temporarily store the message until the satellite was in sight of Japan, Harry could call for "his" messages from around the world. The problem of time differences, sleep schedules, work schedules is overcome. Another very important reason to look at digital techniques is the vast improvement in accuracy attainable even in marginal conditions. Virtually error-free reception is possible with modern error-correcting schemes. That becomes important in terms of emergency communications when garbled text can have grave consequences. With packet radio transmissions the message, when received, is GUARANTEED to be perfect. So we see that PACSAT is quit similar to a computer bulletin board like that run by N5AHD except with PACSAT the user would employ a radio link instead of using long distance telephone calls!

ASR: *Packet radio hardware still seems to be unavailable to the great majority of amateurs. How do you reconcile the equipment vacuum with a suggestion that the PACSAT would be popular? It would seem that only an elite few with access to special equipment would have access to PACSAT.*

W3IWI: The digital hardware available now IS minimal. The Vancouver Area Digital Group have made a few hundred of their Terminal Node Controller (TNC) boards available and they can be found on the air in areas like Washington, D.C., San Francisco, New Jersey, Ottawa and so forth. The Tucson Area Packet Radio (TAPR group is about to distribute nearly 200 of a second generation TNC which costs less than $250 wired and tested. I anticipate that we will see these activities growing in the future and foresee no problem in availability of suitable hardware. Perhaps AMSAT will even become a source of suitable hardware for its members.

ASR: *Why do you believe AMSAT should become involved in packet radio? Doesn't AMSAT's charter call for more traditional satellite development?*

W3IWI: AMSAT's charter calls for advancement of amateur radio technologies...it says so in our bylaws...In this sense if we were not alert to technology opportunities we would be derelict in our responsibility. Moreover, if we fail to innovate, we will have lost our primary asset: access to launch opportunities.

ASR: *Are you saying that it is innovation that*

Folks shown watching a "movie" of KA9Q's Phase III orbit simulation.

WA7GXD speaks about his 24-cm solid-state amplifier modules.

gets rides on launchers?

W3IWI: Not precisely...but it has a great deal to do with the perception of the launch authority as to our credibility. And our credibility in the professional scientific and engineering circles depends critically and ultimately on our collective ability to convince these officials that we know what we are doing, that what we are proposing has technical merit, that it in some way can advance the state of the art and that it will bring some good to mankind. It's as simple as that. Therefore, it is my conviction that we must innovate; it is our primary reason for organizational existance.

ASR: *But where does the user come in? How can he keep pace if you're updating the "machines" one right after the other?*

W3IWI: We are not talking in terms of changes occurring overnight. Rather we are talking about long-term, evolutionary changes, enhancements to our hobby. I emphasize that the PACSAT concept is not meant to displace our present user community or herd them into a packet radio "box" if they don't care to go. No! What we are saying here is that there are remarkable new, exciting avenues of technology to be explored, harnessed and then brought into the amateur satellite hobby. But not at the expense of the traditional activities. To the contrary, we are addressing a NEW branch of a growing tree. Indeed the salient fact here is that AMSAT needs to grow...and to grow in traditional directions as well as some attractive new areas. The PACSAT concept is merely a new branch that will help AMSAT grow into new areas with new people eager and willing to help bear the load.

ASR: *Do you think there is really a "market" for PACSAT out there or are you merely groping about looking for some new challenge?*

W3IWI: The answer to that question is easy...and yet not so easy. First, I am absolutely convinced of a huge, receptive group out there anxious to get on with it. And yes, we do need a challenge for our technical folks. They are in this "game" not as operators or certificate hunters but as dedicated designers and builders. Without grist for their mills there will be no construction, no satellites, no AMSAT, period! Additionally, we have seen a massive increase in digital technology and interest to work in that area. The present team of designers, planners and builders have been sought out by the digital community for help in meeting their goals. In return these new talents have promised support for all our projects.

ASR: *How can you be certain about the appetite for packet radio activity? A couple of AMSAT members strongly suggest the majority of AMSAT members want little or nothing to do with PACSAT. How would you answer their charges of force feeding of PACSAT to the masses?*

W3IWI: I think the best way to answer your question is to point first to some hard facts to underscore why we see a strong future AMSAT involvement in amateur radio digital communications. I would point first to an extensive survey of amateur radio commissioned by the ARRL in 1980. The results of the survey are summarized in *QST*, March, 1981. Of special note is the following.

Martha staffs the check-in desk at the Recreation Center.

First, there are more than five times as many amateurs into personal computing as were involved in amateur satellites. That's very significant! That number has grown since then too. Next, there were one and a half times as many amateurs active in digital communications as there were active in amateur satellites. We strongly suspect that number has grown such that the data communicators now outnumber the satellite communicators by even a wider margin today. But that's history. What about the future? Again we refer to the data in *QST*. What do we find in terms of growth potential? Well for one thing we find that the greatest growth area will be in amateur satellites with one of every five amateurs in the U.S. and Canada either on the birds or planning to be active. The next one is a shock, however. More than one out of FOUR will be active with personal computers. Moreover, one of seven will be active in digital communications. That tells AMSAT something about where the interest lies. It also points to a significant growth opportunity for AMSAT. And it is growth that will afford us the resources to implement our ambitious plans. As we have seen, personal computing will be more popular than amateur satellites. We'd like to combine the interests for those who have a dual interest. In so doing we will benefit all within AMSAT with our diverse views, interests and preferences.

ASR: *What about AMSAT individuals? Have you surveyed them to determine what their feelings are?*

W3IWI: While we haven't conducted a formal survey, we certainly have been soliciting inputs from the members. Since the possibility of a PACSAT mission emerged last summer I have talked in person and by phone with a large number of people across the country and around the world. I have found it necessary to begin these discussions by describing the concept and the anticipated capabilities. I have found essentially universal acceptance of the concept in these discussions. One of those I polled, W0CY, took the question to the Tuesday evening 75 meter Mid-American Net. They devoted the entire evening to a discussion on PACSAT. Jim reported to me that throughout the midwest there was strong support for the concept. Similarly, at the Annual Meeting in October we demonstrated packet radio action and then described PACSAT as a concept. The only reservations expressed were in the nature of, "are we spreading ourselves too thin?" I took these expressions of support to heart in pressing to get a better definition of PACSAT. It is significant that every AMSAT Director and Officer, and a number of key individuals well-connected to the members, are unanimously in favor of proceeding with the PACSAT concept.

ASR: *Aren't they more or less obliged to "go along" with the idea?*

W3IWI: At the recent Board meeting an interesting thing happened. A few of the attendees arrived as skeptics. Once they learned what PACSAT was about and what the long range benefits were, they universally praised the concept... became PACSAT converts... strong supporters.

ASR: *If this is so, then why is there an element of dissent from the members?*

W3IWI: Mainly because we haven't done the best possible job of explaining to the members what PACSAT is about. This situation has really come about because of the speed with which the PACSAT concept is developing. Much of the conceptual work and the contractual relations haven't been worked out yet. This puts us in a very delicate situation of trying to work out some very sensitive negotiations with the entire world eavesdropping on every word. It would be a shame to lose a prospective string of launch opportunities because of our having to negotiate sensitive matters in the open. I believe the PACSAT concept will be warmly embraced by the overwhelming majority when the facts are known. I think the apprehension folks now feel is based on the perception that somehow PACSAT is going to "put them out of business" as far as what they most like to do on OSCARs. As I see it, PACSAT is a project that will augment Phase III and more traditional means of communications rather than displacing them.

ASR: *But with the great recent commotion about AMSAT solvency, isn't PACSAT bound to drain the coffers even further? Given a choice between funding Phase III and funding PACSAT which would you support?*

W3IWI: First let me address the solvency question. We are faced with two problems at this time. With the current size of the membership, the members' dues barely cover the cost of services. Inflation has been whittling away at the "barely" day-by-day. In the past, AMSAT's dues structure has been based on a calendar year basis for all regular (that is non Life) members, and we are now at the end of the year. The treasury is tight because we haven't yet received the torrent of renewals. When AMSAT was smaller, we instituted Life Membership as a convenience to the members and as a way to raise cash to fund Phase IIIA. The dues contributed by our Life Members have constituted a reserve to buffer crisis and the interest derived from these reserves was supposed to pay the Life Member's dues.

After we lost Phase IIIA, W3GEY and I drew up a recovery budget of $270,000 to make Phase IIIB and C happen. We have stuck to that budget but unfortunately we have raised only a bit over $200,000 in the interim. Where did the balance come from? It came from the Life Member reserves. In short, we have mortgaged much of AMSAT's future on the success of Phase IIIB. We anticipate that come April, we will see a large influx of new members. But until then our finances are tight. Therefore don't think of us as insolvent and about to file chapter 11!

Now returning to the original question, I don't feel PACSAT will cause a significant dent in our financial situation. You see, the way the situation is now developing, PACSAT is drawing so much enthusiasm from new contributors, it appears quite likely that PACSAT will be self-funding. That means that it will not compete for funds, for the most part, with Phase III or other key AMSAT projects. We have a substantial number of irons in the fire. It's just good sense to diversify. Our existence is a lot more fragile than most folks would easily perceive. But it's more than the bank balance that makes for a solid organization. It's flexibility and diversity of interest that makes AMSAT strong just as the diversity of interests and talents of our members is a vital component of our strength. So PACSAT adds important breadth and strength to AMSAT without sapping our resources in any meaningful way. And here's the key point that I wish to drive home. The new talents drawn in by the attractive PACSAT project will contribute meaningful dollars and hours to our resources. That will help insure our long-term health. In other words, not only will PACSAT not be a major drain on our coffers, it will likely be a major fundraising focus for thousands of new amateurs. Everywhere I've spoken about PACSAT I've heard enthusiasm. What we really need now is for the REAL word about the PACSAT concept to get out. Then at least if a few folks want something to criticize, they'll have a factual basis from which to offer constructive criticism.

ASR: *You say that PACSAT could be self-funding? How would that work?*

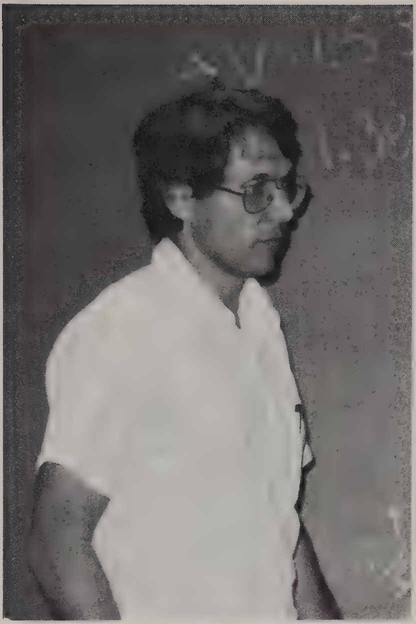
W3IWI: We have several avenues of approaches open to us that would allow the design, construction, test and launch of PACSAT. I can't go into detail here because of the sensitive stage at which negotiations stand, but I can say this. We are working very hard to have the PACSAT concept picked up by a consortium of universities. Part of the funding would come from various AMSAT groups. The major effort would center in the electrical engineering department of one or more universities. Funding would come from grants and staffing would be covered by faculty and student fellowships and the like. We have already had some expressions of interest from external groups who are interested in applying our low-cost technology to non-amateur problems. We can foresee a possible scenario in which a satellite carries two virtually identical transponders OF AMSAT's DESIGN. One would be our PACSAT on Amateur frequencies and the other would be designed to explore non-amateur use of the same technology.

ASR: *What about the launch opportunity? Have you got one and if so, why not use it for another OSCAR 8 or the like?*

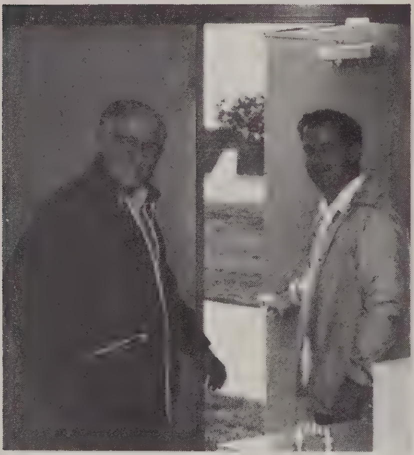
W3IWI: We are diligently working on the launch opportunity now. We believe there is a reasonably good chance that we can obtain a ride with an early Space Services Incorporated launch in 1984. Martin Sweeting, G3YJO, is talking with SSI about the launch opportunities now. We have also identified a possible NASA launch into similar orbit in about the same time frame. Beginning in 1985 the Shuttle may provide us with polar, OSCAR-8-like orbit opportunities. As for using these types of opportunities for another linear transponder, OSCAR-8-type satellite, that is unlikely for several reasons. First of all, with at least one and possibly two Phase III birds up and running, the potential user community for an OSCAR 8-type satellite will diminish radically. For those still interested, we have fairly good confidence that a long stream of RS and ISKRA birds will be available for years to come. In essence, however, once the amateur community gets to know Phase III and has the prospect of Phase IV geosynchronous satellites in view, we see very little utility for these low earth orbits except for some special tasks. PACSAT

W1HDX holds a 100-watt 24-cm amplifier (2 X 2C39's) made by Parabolic (SM6CKU, Bengt Jockect). On the table is a Japanese two meter — 24 cm transverter which develops three watts and is marketed by Spectrum West.

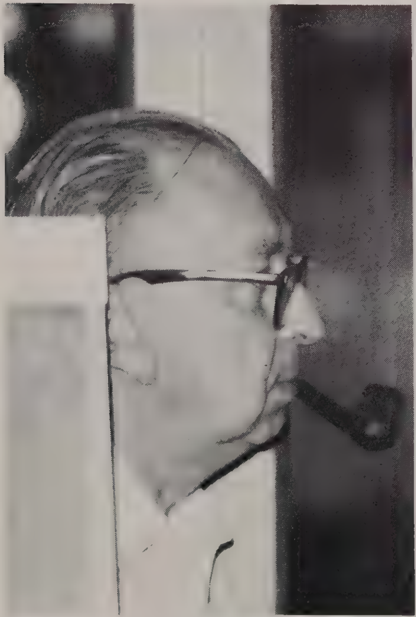
Chow time



W3GEY discusses Phase III orbit options.



W6KBD (left) and K3NW leave the Lab.



Hitchcock? No. Just K2ZRO at the A.G.M.

is one of those special tasks that is ideal for that orbit since every station on earth has access for a few passes every day. Since the satellite is closer than Phase III, the users' RF requirements are minimized. Since the passes for any one station are brief and since a small part of the earth is covered at any one time, the user QRM problems, which are critical for digital communications, are minimized. Just imagine what the RS robot would have sounded like if it had been in Phase III's high altitude orbit! In short, it seems to us that packet radio is a perfect user for any low-altitude satellite launch opportunities we can promote. And that's why we're advocating PACSAT.

ASR: *Why is it that you believe you understand what is needed whereas you say your critics miss the point?*

W3IWI: Sitting in the President's chair gives one a perspective that is not available elsewhere. My job as President requires me to be aware and respond to both the short term and long term goals of our organization. To do this...to make critical judgments...I must rely on my key staff advisors, the officers, directors and project managers. And I must in the end rely on my best judgment and expertese. That IS after all what leadership is about. Rendering one's best judgment given imperfect information at an inopportune time under the worst of possible circumstances! I frankly believe I could've done worse. Sure I've made some blunders...but I sure don't think PACSAT is one of them! To the contrary, from where I stand PACSAT is an exciting new concept...the right idea at just about the right time...to benefit AMSAT enormously if...and I emphasize IF...we know how to capitalize on it. I am encouraged to note that the entire directors and officer staff agrees with me on this one. Can twenty million Frenchmen...or twenty AMSAT veterans be wrong?!

ASR: *How much money has been spent out of AMSAT's coffers so far on PACSAT?*

W3IWI: About one thousand dollars in seed money has been expended to date. This has been used to cover travel and telephone calls so that certain key individuals could get together to discuss the concepts and to see if a workable project could be devised. The Board of Directors has approved a budget to continue these definition activities for the next few months at a level not to exceed $4000.

ASR: *Isn't that rather risky given the state of AMSAT's reserves?*

W3IWI: Let's set some numbers out so we can see what we are talking about. AMSAT's budget for Phase III was $270,000. The PACSAT seed money is less than one per cent of that. Sure a thousand bucks is a lot of cash. But its less dramatic when put against the fact that we've already spent more than a quarter million bucks on Phase IIIB and C. Furthermore, although we have been rattling the tambourine for more donations now for several weeks, this is something we are forced to do by the very nature of our being. That is, as a non-profit corporation we must constantly point out our needs in order to raise funds. We have never been and will never be well-off as far as reserves. It's just the nature of the beast. Also, we tend to be conservative in fiscal matters and try to portray our needs in terms that will motivate folks to chip in where needed. This year our revenues were less than expected, mainly because of the Phase IIIB launch delays, and so we are beating the tambourines a little harder than usual. This doesn't mean we're about to fold. Not at all. We do have adequate reserves to cover most contingencies until next year. But we certainly want to encourage folks to renew and donate so that we can be as fiscally sound as ever.

ASR: *Could you summarize your sentiments on the subject of PACSAT?*

W3IWI: To me and all the folks I've talked with directly, PACSAT is one of the most exciting, enthusiasm-building concepts to come along. It will draw thousands of new contributors into the AMSAT fold. This diversification will be important to AMSAT's future as we reach out to various groups and interests who want to follow our lead in amateur space activities. Each of the adjunct activities will tend to support and focus on our mainstream "business" of building the most advanced amateur communication satellites for our members to use and enjoy. And the very nature of these challenging new resources will insure AMSAT's longevity and fiscal health. And it will help re-establish Amateur Radio's position of prominence in advancing state-of-the-art communications techniques. Further, it has the possibility of promoting ties to certain non-amateur groups which can only strengthen our future position. Each of the projects in AMSAT will coexist and be mutually beneficial. The result will be a broad suite of space resources from which a member can choose his favorite be it traditional sideband or cw or more advanced techniques such as synthesized digital voice, digitized video and others. I recall a fanciful prospectus written by WA2LQQ and published in *Orbit* #1. The basis of the story was the use of the AMICON channel of Phase III. But the message that digital communications had arrived in the world of Amateur Radio was the main theme. I believe it. So do a lot of other people. AMSAT will be there among the leaders in taking digital techniques into space...our traditional innovation grounds!

Nadia Marie King (2nd harmonic of W3GEY) indicates her age at the dinner hour of the A.G.M.

Satellites & 73

When it comes to covering satellite communications, *73* runs rings around the competition. *73* publishes more articles about satellites and TVRO than any other ham radio magazine.

- more OSCAR articles
- more LISTENING articles
- more TVRO articles

In fact, since January of 1982, satellite-related articles have averaged 25% of the total number of articles published per issue of *73*. The most recent of those covered such topics as:

- OSCAR Tracking Antennas
- PHASE III
- OSCAR By The Numbers

And our regular monthly feature "SATELLITES" contains the latest AMSAT news, news of the Soviet satellites, OSCAR orbits, and more.

Learn more about satellite communications—subscribe to *73* Magazine and receive 12 monthly issues for only $19.97. Simply complete the coupon below (a photocopy is acceptable) and mail it to:

73 Magazine
P.O. Box 931
Farmingdale NY 11737

☐ **YES!** *I want 12 issues of 73 for only $19.97.*

☐ *Check Enclosed* ☐ *Bill Me* ☐ *VISA* ☐ *MC* ☐ *AMEX*

Card# ______________________ Exp. date __________

Signature ______________________ Interbank # __________

Name ______________________

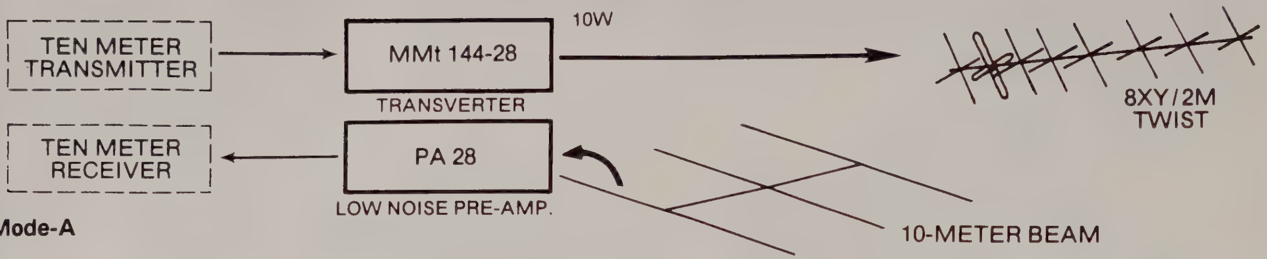
Address ______________________

City ______________________ State __________ Zip __________

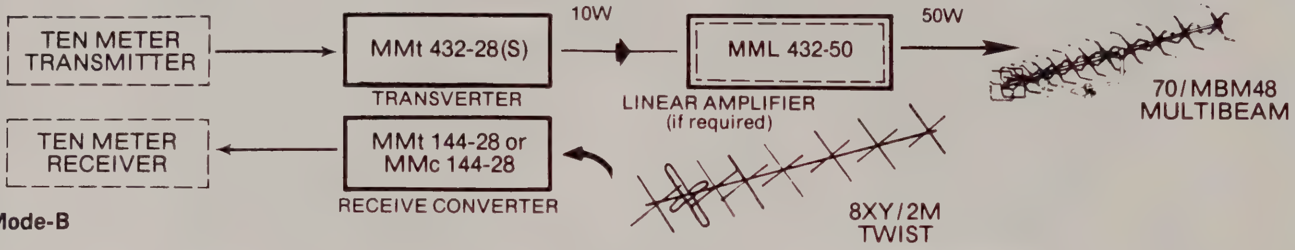
Canada and Mexico—$22.97 1 year US funds only
Foreign surface—$39.97 1 year US funds drawn on US bank only
Foreign Airmail—Please Inquire
Allow 6–8 weeks for delivery.

73 Magazine ● *PO Box 931* ● *Farmingdale NY* ● *11737* 728RBT

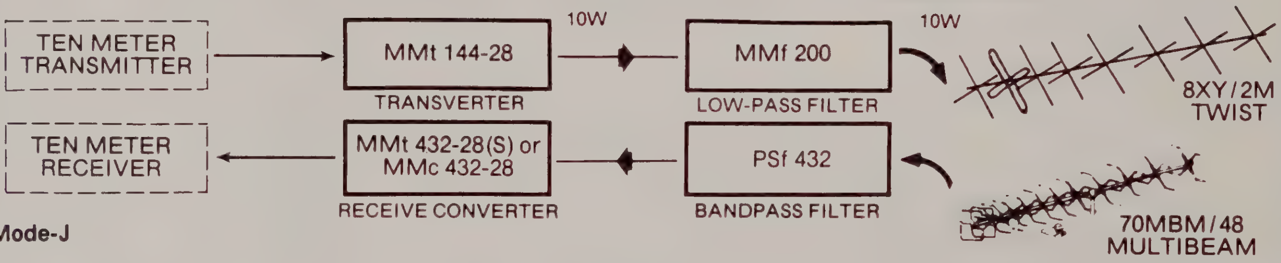
OSCAR SYSTEMS FROM SPECTRUM INTERNATIONAL



Mode-A



Mode-B



Mode-J

CONVERTERS AND TRANSVERTERS FOR

OSCAR 7
OSCAR 8
PHASE III

Specifications:

Output Power: 10W.
Receiver N.F.: 3 dB typ.
Receiver Gain: 30 dB typ.
Prime Power: 12 Vdc

Receive Converters

MMc 144	$59.95
MMc 432-28(s)	$81.50
MMc 432-28(TC)	$79.95

UHF Filters:

MMf 200-5	$31.95
MMf 200-7	$42.95
PSf 432	$59.95

Receive Preamplifier:

PA-28 $35.95

Mod. kit to adapt original MMt 432-28 FOR Mode-J operation: $26.50

Transverters by Microwave Modules and other manufacturers can convert your existing low-band rig to operate on the VHF and UHF bands. Models also available for 2M to 70 Cm and for ATV operators from Ch2/Ch3 to 70 Cm. Each transverter contains both a Tx up-converter and an Rx down-converter. Write for details of the largest selection available.

Attention owners of the original MMt 432-28 models: Update your transverter to operate OSCAR 8 and Phase III by adding the 434 to 436 MHz range. Mod. kit including full instructions is $26.50 plus $1.50 shipping.

ANTENNAS

2-Meter 8 + 8 Twist Model 8XY/2M	$57.75
Phasing Harness Model PMH/2C	$12.35
48 el. 70 Cm Multibeam Model 70-MBM-48	$75.75
88 el. 70 Cm Multibeam Model 70-MBM-88	

(ALL PRICES FOB CONCORD, MASSACHUSETTS)

Send 36 cents (two stamps) for full details of KVG crystal filters and other products to fill all of your VHF/UHF equipment needs.

Preselector Filters • Amplifiers • SSB Transverters
Varactor Triplers • Counters • FM Transverters
Antennas • Decade Prescalers • VHF Converters
Oscillator Filters/Crystal Filters • UHF Converters

Master Card, VISA Card accepted

Spectrum
International, Inc.
Post Office Box 1084R
ncord, Mass. 01742, USA

More Satellite Log. . .

Cosmos 1405 (1982-88A) launched on 1982 Sep 4; initial orbit: 93.31 min, 65°.02, 445 km, 429 km; transmissions: none reported. Ocean radar reconnaissance satellite.

Cosmos 1406 (1982-89A) launched on 1982 Sep 8; initial orbit: 88.89 min, 82°.30, 222 km, 214 km; transmissions: none reported. Recoverable reconnaissance satellite.

China 10 (1982-90A) launched on 1982 Sep 9; initial orbit: 90.08 min, 62°.98, 385 km, 174 km; transmissions: none reported. Chinese reconnaissance satellite ejected re-entry capsule 1982 Sep 14.

Cosmos 1407 (1982-91A) launched on 1982 Sep 15; initial orbit: 89.35 min, 67°.16, 312 km, 172 km; transmissions: none reported. Recoverable reconnaissance satellite.

Cosmos 1408 (1982-92A) launched on 1982 Sep 16; initial orbit: 97.68 min, 82°.62, 666 km, 637 km; transmissions: none reported. Electronic surveillance satellite.

Ekran 9 (1982-93A) launched on 1982 Sep 16; initial orbit: 1436.03 min, 0°.36, 35857 km, 35721 km; transmissions: 702 to 726 MHz, 714.000 MHz. Direct broadcast satellite at Statsionar T location over 99° East.

Progress 15 (1982-94A) launched on 1982 Sep 18; initial orbit: 89.31 min, 51°.64, 272 km, 214 km; transmissions: none reported. Cargo and supply spacecraft docked with Salyut 7 on 1982 Sep 20.

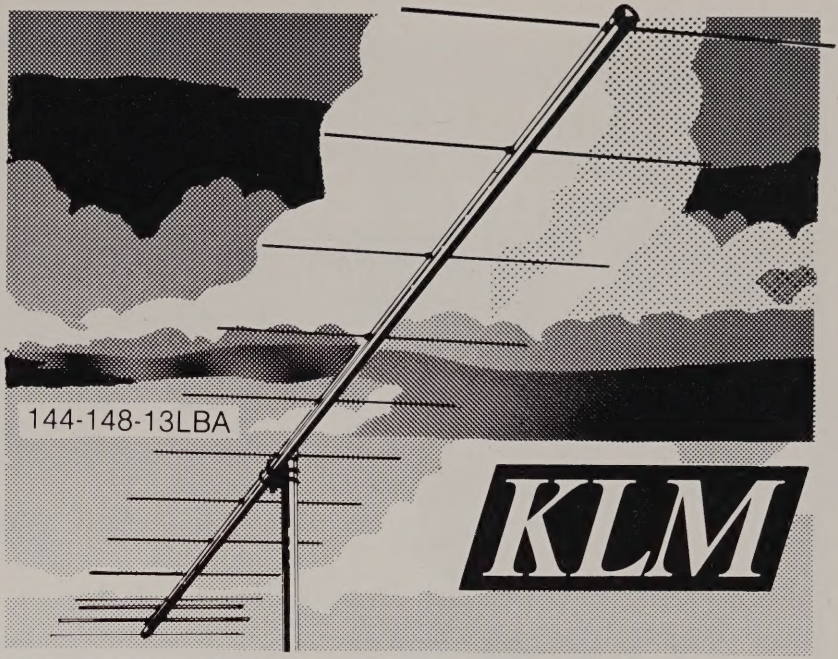
Cosmos 1409 (1982-95A) lauched on 1982 Sep 22; initial orbit: 716.69 min, 63°.08, 39702 km, 613 km; transmissions: 2280 to 2304 MHz, 2292.000 MHz. Early warning satellite.

Cosmos 1410 (1982-96A) launched on 1982 Sep 24; initial orbit: 115.99 min, 82°.61, 1503 km, 1495 km; transmissions: none reported. Tactical communications satellite.

Intelsat 5E (1982-97A) launched on 1982 Sep 28; initial orbit: 1435.69 min, 1°.55, 35807 km, 35757 km; transmissions: as Intelsat 5D plus 1535.000 to 1542.500 MHz and 4192.500 to 4200.000 MHz. International telecommunications satellite with maritime communications subsystem for service over Indian Ocean.

Cosmos 1411 (1982-98A) launched on 1982 Sep 30; initial orbit: 90.08 min, 72°.86, 358 km, 198 km; transmissions: none reported. Recoverable reconnaissance satellite.

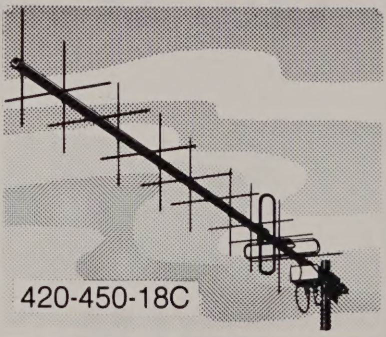
Satellite News: The news bulletin of satellites, spacecraft and space activity is available in four editions: *Space Objects Digest, Military Space Digest, Space Operations Review* and *Space Systems Digest.* The price is 25 cents per issue: subscribe for as many issues as you like. Payments and orders by International Money Order, cash or check. Please add $2 to personal checks for UK bank charges. Orders should be sent to: Geoffrey Falworth, 12 Barn Croft, Penwortham, Preston PR 10 SX, England.



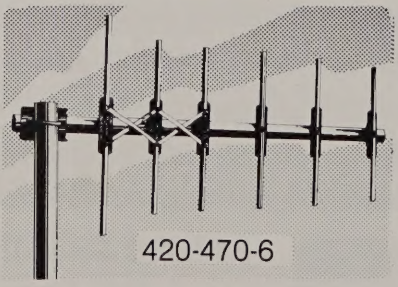
WHY SETTLE FOR HALF THE BAND?
Enjoy super-gain, low VSWR, and FULL COVERAGE, 144 through 148 MHz, with less weight and windload. Dual-driven elements, balanced feed for a better match and clean pattern.

Bandwidth:	144-148 MHz	Balun:	2KW 4:1
Gain:	15.5 dBd	Boom:	21' .5/1½''
VSWR:	1.2:1 & less	Windload:	1.6 sq ft
Beamwidth:	28°	Weight:	9 lbs

CIRCULAR POLARIZED For the Phase IIIB satellite and terrestrial DX, ATV, and FM. Minimizes multipath and flutter fading. Rugged symmetrical construction.



Bandwidth:	420-450 MHz		
Gain:	12 dBdc		
VSWR:	1.5:1 & less		
F/B:	20 dB		
Baluns:	2KW, 4:1 (2)	Windload:	.5 sq ft
Boom:	88''/1''	Weight:	3.6 lbs



IDEAL for point-to-point and repeater control. Rear-mounted, vertically polarized, compact. Continuous coverage, 420-470 MHz. Direct coax feed suitable for most installations.

		Bandwidth:	420-470 MHz
		Gain:	8dBd
		VSWR:	1.2:1 & less
Boom:	2'/1'' O.D.	Beamwidth:	60°
Weight:	1.2 lbs	F/B:	20 dB, min

SEE YOUR KLM DEALER:

KLM Electronics, Inc. P.O. Box 816, Morgan Hill, CA 95037
(408) 779-7363

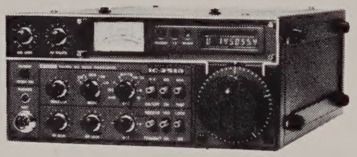
Your Satellite Headquarters

Electronic Equipment Bank

516 Mill Street N.E. Vienna, VA 22180

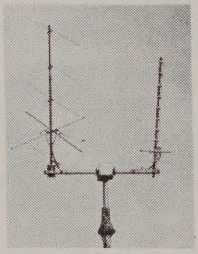
EEB

ICOM



YAESU

Cushcraft



KLM

...and others

Look to EEB for all the best from:

AEA
Beckman
Columbia
Diawa
Henry
Hustler
ICOM
In-Line
KLM
Leader
McKay
Mirage
Palomar
Rohn
Unadilla
Yaesu
Sanyo

Bird
Bencher
Dentron
Fluke
Hitachi
Hy Gain
Info-Tech
Kantronics
Larsen
Lunar
MFJ
Nye Viking
Robot
Sony
Vocom
HAL
Zenith

We carry a complete line of Sanyo and Zenith monitors at special prices. In addition, we stock all necessary components to make up a working OSCAR station. EEB is your one-stop place to shop for Phase IIIB operating hardware. We're ready, are you?

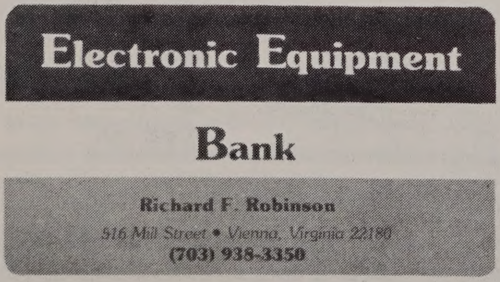
EEB

EEB

EEB

EEB

Rotors • Amplifiers • Receivers
Power Supplies • Cable • Transceivers
Antennas • Preamps • Converters • Transmitters
• Wattmeters • Connectors •



Electronic Equipment

Bank

Richard F. Robinson
516 Mill Street • Vienna, Virginia 22180
(703) 938-3350

Please call us for pricing information:

703-938-3350

Tues. Wed. Fri. 10 A.M.-5 P.M.
Thurs. 10 A.M.-9 P.M. Sat. 10 A.M.-4 P.M.
Closed Sunday and Monday

We accept VISA/MC Sorry No COD

Plan to visit us the next time you're in Washington, DC

By Popular Demand . . .

Yaesu's All-New VHF/UHF Transceivers!

Yaesu is proud to introduce a new generation of computerized VHF and UHF equipment. With the features you have asked for and the quality you demand, these revolutionary transceivers are your passport to the newest frontiers in Amateur Radio!

COMPLETE OSCAR STATION!

- **FT-480R - 143.5 to 148.5 MHz SSB/CW/FM**
- **FT-780R - 430-440 MHz SSB/CW/FM**
- **SC-1 Station Console w/Digital Clock**

A complete microprocessor-based communication system with convenient switching of scanning and microphone controls, AC power supply, and 16 button tone pad.

FT-290R 2M MULTIMODE PORTABLE!

- **Battery Powered (NiCd C-Cells Optional)**
- **LCD Display with Night Light**
- **USB/LSB/CW/FM with 2.5W RF Output**

An entirely new concept in VHF operating! LCD display with full microprocessor control, 10 memories, two VFO's and multimode flexibility, all from a battery powered package. Telescoping antenna built in. Optional FL-2010 PA and FP-80A AC Supply.

FT-208R

2 METER FM HAND-HELD!

- **LCD Display with Lithium Backup Cell**
- **Selectable 5 kHz/10 kHz Scanning**
- **10 Memories with Auto/Resume Scan**
- **16 Button Tone Encoder**

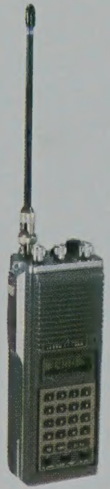
Yaesu's latest thoroughbred for 2 FM is the FT-208R Hand-Held. Four digit LCD display, 10 memories, limited band scan, and priority channel make this the most versatile hand-held ever made available to the amateur fraternity.

FT-690R

6 M MULTIMODE PORTABLE!

- **USB/CW/AM/FM Battery Portable**
- **LCD Frequency Display with Night Light**
- **10 Memories with Lithium Backup Cell**

Catch those exciting DX openings with the new FT-690R 6 meter portable. Repeater shift (1 MHz), two scanning steps per mode, and dual VFO's for top flexibility.



FT-708R

70 CM FM HAND-HELD!

- **LCD Display with Lithium Backup Cell**
- **Selectable 25 kHz/50 kHz Scanning Steps**
- **440-450 MHz with 10 Memories**
- **Memory/Band Scan and Limited Band Scan**
- **Resume Scan**
- **16 Button Tone Encoder**

Yaesu leads the way with its pioneering microprocessor controlled 440 MHz hand-held. Priced competitively against much simpler units, the FT-708R system includes a full line of accessories, including CTCSS, NiCd chargers, and remote speaker/microphone options.

Sporting unmatched engineering and manufacturing know-how, Yaesu's technical staff is committed to pushing the state of the art. Yaesu products are backed by a nationwide dealer network and two factory service centers for your long-term service needs. So when it's time to upgrade your station equipment, join the thousands of hams that are tired of compromise – join them by investing in Yaesu!

Some accessories pictured above are extra-cost options. See your Yaesu dealer.

Price And Specifications Subject To Change Without Notice Or Obligation

YAESU

The radio.

YAESU

881

YAESU ELECTRONICS CORP. 6851 Walthall Way, Paramount, CA 90723 • (213) 633-4007
Eastern Service Ctr., 9812 Princeton-Glendale Rd., Cincinnati, OH 45246 • (513) 874-3100

MIRAGE

American made RF Amplifiers and Watt / SWR Meters of exceptional value and performance.

•5 year warranty • prompt U.S. service and assistance

RF AMPLIFIERS

2 METERS-ALL MODE

B23 2W in = 30W out $89.95
(useable in: 100 mW-5W)

B108 10W in = 80W out $179.95
(1W = 15W, 2W = 30W) RX preamp

B1016 10W in = 160W out $279.95
(1W = 35W, 2W = 90W) RX preamp

B3016 30W in = 160W out $239.95
(useable in: 15-45W) RX preamp
(10W = 100W)

220 MHz ALL MODE

C106 10W in = 60W out $199.95
(1W=15W, 2W = 30W) RX preamp

C1012 10W in = 120W out $289.95
(2W = 45W, 5W = 90W) RX preamp

C22 2W in = 20W out $89.95
(useable in: 200mW-5W)

RC-1 AMPLIFIER
REMOTE CONTROL $24.95
Duplicates all switches, 18' cable

WATT / SWR METERS

- peak or average reading
- direct SWR reading

MP-1 (HF) 1.8-30 MHz
MP-2 (VHF) 50-200 MHz
$119.95

430-450 MHz ALL MODE

D24 2W in = 40W out $199.95
(1W = 25W)

D1010 10W in = 100W out
(1W = 25W, 2W = 50W) $319.95

Available at local dealers throughout the world.

MIRAGE
COMMUNICATIONS EQUIPMENT, INC.

P.O. Box 1393, Gilroy, CA 95020 (408) 847-1857